RESPONSIVENESS OF MERCHANDISE TRADE FLOWS TO CHANGES IN THE REAL EFFECTIVE EXCHANGE RATE, IN ZAMBIA

By

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DECLARATION

I (Ngwale Mwamina-Bantu-Tanaka) hereby declare that this dissertation:

1. Represents my bona fide work;
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3. Does not incorporate any other previous work without acknowledgement.

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ABSTRACT

Economic theory on trade flows postulates that depreciation does not guarantee an automatic improvement of the Balance of Payment (BoP) unless the Marshall-Lerner (M-L) condition is fulfilled. In this regard, most Sub-Saharan African countries (including Zambia) are still grappling with the problem of BoP disequilibrium despite experiencing steady depreciation. The objective of the research was to establish if depreciation of Real Effective Exchange Rate improves the Current Account of Zambia's BoP through growth in non-traditional exports and reduction in imports. The Single Equation Error Correction Model and the Bewely Transformation Regression were applied on 2000q4-2011q4 data obtained from the Bank of Zambia. The findings were that variables in the study are integrated of order 0 and 1 and both the export and import models were cointegrated. Further findings were that both in the short and long-run, depreciation of Real Effective Exchange Rate (REER) increases the real value of exports. The findings also show that in the short-run depreciation is effective in reducing imports but not in the long-run. The results further reveal that in the short-run, the sum of the estimated REER elasticities of exports and imports exceed 1 meaning that the M-L condition holds, thus implying that a real depreciation of the Kwacha improves the BoP. In the long-run, the M-L threshold is not applicable since imports continue to grow despite depreciation signifying that the short-run improvements in the BoP due to depreciation are not predicated on fundamentals. Thus, in the long-run, depreciation can be effective if supplemented with a policy instrument that reduces expenditure on imports. In view of this, the researcher recommends that future studies be carried out, that will focus on finding a complementary policy instrument that would render depreciation effective based on fundamentals. The results also revealed that in the short-run imported inputs increase exports and thus policy makers should be cognisant of this fact and henceforth pursue policies that do not hamper importation of inputs. The study had one major limitation of not having Gross Domestic Product quarterly data which would have been a better proxy for quarterly domestic income. Thus, the researcher recommends that institutions responsible for managing Zambia's economic data, should urgently improvise a proxy for quarterly national income that would be more representative other than the real total value of imports to help future researchers.

DEDICATION

To my late friend, Leonard Sibajene, who died on 29th March, 2013 at the University of Zambia (Ridgeway Campus) in his study room a few days before completing his seven-year study in medicine.

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LIST OF ABBREVIATIONS AND ACRONYMS

ARDL	Auto-Regressive Distributed Lag
BoP	Balance of Payment
BoZ	Bank of Zambia
CSO	Central Statistical Office
CPI	Consumer Price Index
GDP	Gross Domestic Product
EER	Effective Exchange Rate
ECM	Error-Correction Model
ex	Total Merchandise Exports less All Metal Exports
im	Total Merchandise Imports less Fertilizer, Petroleum and Metals
IM	Imported Inputs (including only Fertilizer, Petroleum and Metals)
IMF	International Monetary Fund
ln	Natural Log
ZMW	Zambian Kwacha
M-L	Marshall-Lerner
NEER	Nominal Effective Exchange Rate
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
REER	Real Effective Exchange Rate
RER	Real Exchange Rate
RP	Relative Price
SDR	Special Drawing Rights
SEECM	Single Equation Error Correction Model
WB	World Bank
wi	Real Weighted Income for Zambia's Major Export Destinations
zi	Zambia's Real Income

CHAPTER 1

INTRODUCTION

1.0 Overview

From theoretical point of view, a liberal economy open to international trade is, undoubtedly, more likely to record sustained and accelerated economic growth, which is a necessary condition for human development. Ironically, most Sub-Saharan African countries, including Zambia, despite liberalizing and opening their economies to international trade between 1970's and early 1990's, are still grappling with macroeconomic problems. These problems include, inter alia, Balance of Payments (BoP) disequilibria due to current account deficits, inflation, and volatile exchange rates, which all impinge on economic growth. In response to the persistence of these macro-economic phenomena, different Sub-Sahara African countries have implored different strategies and policies as panaceas to these macroeconomic problems.

Among these macroeconomic challenges, the case of the current account deficit in the BoP has been responded to by Sub-Sahara African countries by letting the local currency steadily depreciate.

Parallel to the above method of clearing the BoP disequilibria, in the short-run, a current account deficit of a country may be partly financed by capital inflows from abroad, with a view to improving the level of production capacity, which in the end would improve the current account and consequently settle the BoP disequilibria. However, in the long-run, this way of financing current account deficit is not viable because a continuous capital inflow implies that a country is accumulating the stock of foreign liabilities and this means a worsening of the future current account, as interest is paid abroad in future.

In the latter argument, coupled to the long-run challenge of a country risking being an ever-increasing debtor to the rest of the world, if dependent on capital inflows for settling current account deficits, is the advent of global financial recession in the world economy. This has further denied countries facing current account deficits an

opportunity to easily access capital inflow for financing short-run current account deficits.

1.1 Developments in Zambia's Exchange Rates and Trade Flows

1.1.1 Exchange Rates

In 1964 when Zambia got her independence there was a Gold Standard Exchange Rate regime in place and therefore, the country did not pursue an independent exchange rate policy, because of the inheritance of the past colonial policy. However, with the coming of the United Nation Independence Party, there was an introduction of a fully convertible currency system, where the Zambian pound was pegged to the British pound. The pegging system stayed in place until 1968 when it was replaced by the Zambian kwacha at an official rate of K0.714 per US dollar and K1.7 per British pound sterling. Despite adopting the kwacha as the official currency, it still remained tightly pegged to the British Pound Sterling until December 1971 when this link was switched to the US dollar. At this time, the exchange rate remained at K0.714 per US dollar, and this was made possible by devaluing Kwacha through reducing the gold content by 7.9 percent, which fully reflected the devaluation of the US dollar that took place in August 1971. Further, in 1973 the Kwacha was revalued to K0.643 per US dollar. The revaluation of the Kwacha was made possible by increasing the gold levels by 7.9 percent (Mungule; 2004).

During this era, there were worldwide efforts to manage exchange rates on the basis of the Gold Standard system. Nonetheless, the US dollar's strength against other currencies could not be contained. In this regard, the Zambian currency became overvalued, a factor that greatly contributed to the deterioration of Zambia's current account as a result of the loss of competitiveness for export goods. In 1970s the decline in the current account was further worsened by two more harmful shocks to the Zambian economy, namely, the decline in copper prices and a rise in oil prices at about the same period. In 1976, as a response to these economic calamities, macroeconomic policy authorities decided to un-peg the kwacha from the US dollar and pegged the kwacha to the Special Drawing Right (SDR) at an official rate of 1.0848. Given this SDR, the actual devaluation of the kwacha was estimated to be at 20 percent. Later, two devaluations took place, with 10 percent in 1978 and a further

20 percent in 1983 leaving SDR at an official rate of 0.9763. These devaluations took place under the auspices of the Breton Woods institutions notably the IMF and WB, at which period they were being consulted on Zambia's economic management (Ng'ambi; 2004).

In 1991 Zambia experienced a major political change from a one party state to a multi-party system of political governance. The political change was accompanied by major changes in economic and social sectors. Since then, liberalization and privatization of the economy became the guiding national macroeconomic policy framework for Zambia. In this regard, Zambia's exchange rate regime was changed from fixed to a floating regime where market forces, through demand and supply, now determined the exchange rate.

Summary of Exchange Rate Policy Regimes in Zambia

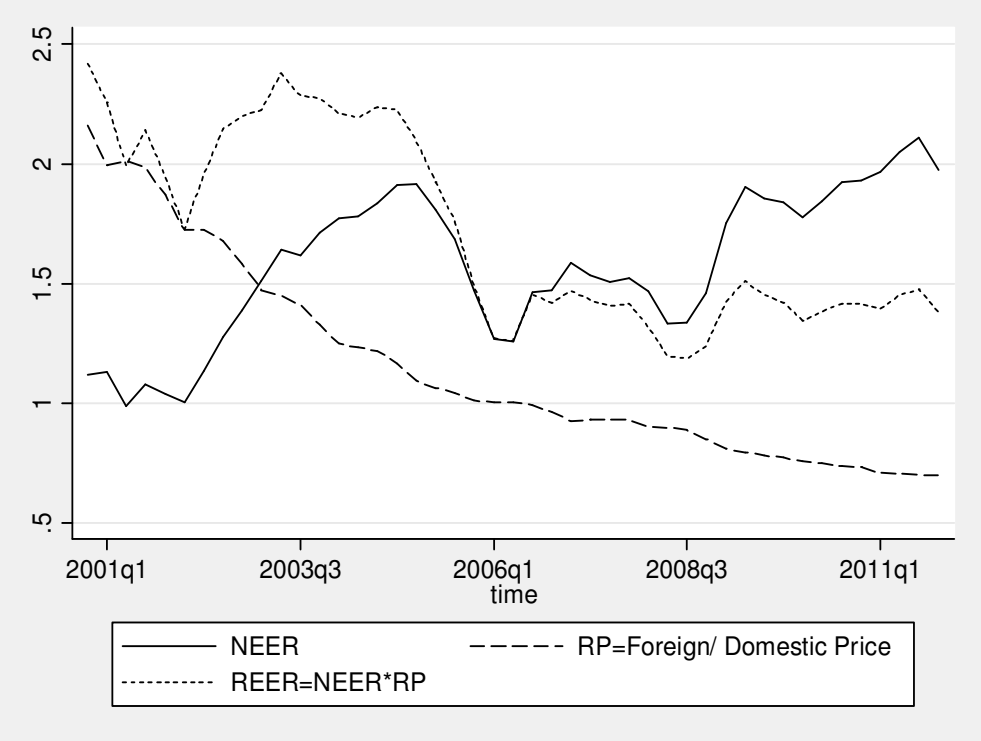
Period	**Exchange rate policy description**
1964–1971	Rates fixed to the British Pound Sterling
1972–1976	Rates fixed to the US dollar
1977–1982	Pegged to the SDR with occasional devaluations
1983–1984	Pegged to a basket of major trading partners' currencies
1985–1987	Foreign exchange Dutch auction system introduced
1988–1989	Fixed parity to the US dollar re-introduced with occasional devaluations
1990–1991	Dual exchange rate system (managed float)
1991–1992	Open general license (OGL) system, rate unified
1992–to date	Fully liberalized exchange rate policy

Source: Bank of Zambia

Below is a figure showing developments in Zambia's effective exchange rates (nominal and real) and the relative price, from 2000-2011

Figure 1: Effective Exchange Rates (Nominal and Real) and Relative Price[1]

[1] Data Source: BoZ Exchange Rates



From Zambia's point of view REER can only depreciate if, and only if, the NEER and/ or the RP are increasing. From arithmetic point of view, the RP can only rise if local prices reduce relative to foreign prices. From the visual inspection of the figure above it is evident that the Relative price has been steadily reducing during the period under consideration, hence at some points REER has been appreciating despite depreciation in the NEER.

1.1.2 Trade Flows

At independence, Zambia inherited from the colonial era an economy largely dependent on the mining industry. During the 1960s, this made Zambia a mono-sector economy that was vulnerable to external shocks given the instability of commodity prices that were soon going to hit the world economy. Exports in copper and cobalt had been the major contributors to Zambia's income from trade while on the other hand importation of petroleum products had been dominant on the debit side of Zambia's trade balances. In 1964, copper export earnings contributed about 91 percent to total export earnings, a figure that grew to a higher consistent level of 96 percent in 1970 and declined to a level of about 83 percent in 1986. By 1996,

copper contribution to exports had declined to approximately 58 per cent. By and large, it was the favorable metal prices coupled with high mineral production, and the resultant accumulation of international reserves during the copper boom period (1964-74) that enabled Zambia to construct infrastructure after independence.

Unfortunately for Zambia, the domestic structure of the economy considerably changed when the fragile position of the economy (with respect to external shocks) was exposed to the adverse effects that followed the end of the copper boom (around 1974) and rise in oil prices which changed the world pattern of prices and demand for goods.

This culminated in a number of problematic macroeconomic phenomena that now define Zambia's economic profile. With regard to Zambia's international trade, some of the noticeable trends that mushroomed from the adverse effects of the end to the copper mining boom were: the accumulation of short-term trade deficits and the associated debt; a persistent Balance of Payment disequilibrium with the associated depletion of foreign reserves; an increasingly overvalued domestic currency which was due to a fixed exchange rate and foreign exchange controls (until 1992); and a highly inefficient industrial sector.

Attempts to transform the Zambian economy into a diversified and modernized economy were largely hinged on international trade policies. For instance, the import-substitution strategy of the late 1970s involved significant direct and indirect trade controls including a highly differentiated tariff structure with high tariffs as well as several administrative controls. Domestic manufacturers who were highly dependent on imported inputs were also heavily subsidized to cushion them from the effect of the price-wedge created between foreign (suppliers') prices and domestic prices of inputs. Similarly, the attempt to change the Zambian economy into a progressive mixed economy in the 1980s was, inter alia, characterized by trade liberalization strides. During this period, the International Monetary Fund and the World Bank negotiated for economic reforms under Structural Adjustment Programs (SAPs) for countries that were going through hardships due to the aforementioned difficulties. Despite the resentments from a number of governments, the IMF and the WB played a significant role in influencing economic transformation during this era, in countries like Zambia. Further, in 1992, Zambia undertook a radical reform that

was aimed at moving the economy towards a free market economy which encompassed trade liberalization as a key reform.

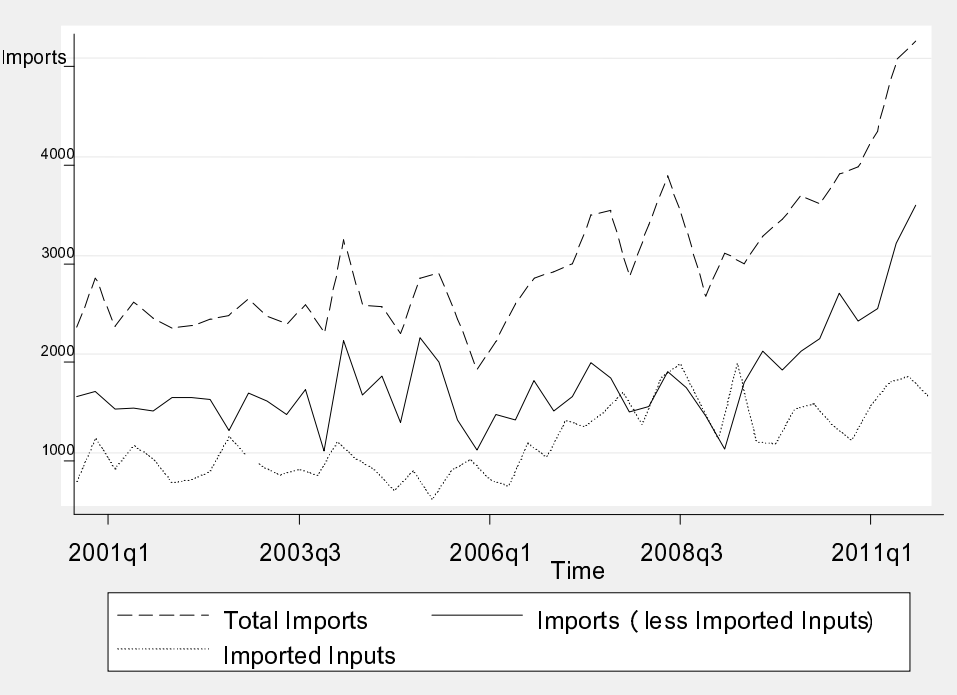
The following figures demonstrate developments in Zambia's trade flow from 2000-2011.

Figure 2: real value of exports (million ZMW[2])

From the figure above, it is evident that during the period under review, non-traditional exports had been relatively constant compared to metal exports which had been rising and dominating non-traditional exports. Therefore, the movements observed in the total exports are largely dictated by movements in metal exports as manifested in the synchronized phase movement between metal exports and total exports graphs.

Figure 3: real value of imports (million ZMW[3])

[2] Rebased Zambian Kwacha
[3] Rebased Zambian Kwacha



It is important to state that in this research, imports for petroleum, fertilizer and all metals are aggregately and loosely referred to as imported inputs and not that these three imports are necessarily the only imported factors of production (inputs). Strictly, there are many more other factors of production, such as agro-chemicals other than fertilizer, that are imported but could not be included in this study as part of imported inputs because they are not reported as individual entries in the BoP as is the case for petroleum, fertilizer and metal imports.

In the figure above, none of the graphs between imported inputs and imports (less imported inputs) seem to be synchronized with total imports throughout, as each graph demonstrates a comparative influence on total imports at some point. However, on average, imports less inputs seem to dominate imported inputs during the period 2000-2011.

1.2 Problem Statement

For a country like Zambia the prospects for sustained economic growth over the long run are closely tied to the diversification of exports as outlined in the Fifth National Development Plan.

In a floating exchange rate regime (which is practiced by Zambia) enhancing non-traditional exports may be attainable through real depreciation of the Kwacha. Real depreciation of the Kwacha makes prices of domestically produced goods lower than prices of foreign produced goods. Thus, depreciation will promote expenditure on domestically produced goods and inhibit expenditure on foreign produced goods both in the domestic and foreign markets (volume effect). On the other hand, depreciation is costly to the nation because it implies exporting at a lower price and importing at higher price (price effect).

The Marshall-Lerner condition states that depreciation will improve the BoP only if the sum of the foreign elasticity of demand for exports and the domestic elasticity of demand for imports is greater than unity. If the sum of these elasticities is less than unity, then depreciation will lead to deterioration of the BoP because the price effect will outweigh the volume effect.

In Zambia, the problem is that there is no evidence that suggest that the BoP has improved through growth in non-traditional exports and reduction in imports. Previous studies on trade balances have consistently attributed improvements in the BoP to favorable performance in the metal sector alone. For instance, according to the IMF (2006) report, the favorable performance of the Zambian economy in recent years has largely been driven by a rebound in copper sector output following the privatization of the main mining company in 2000, as well as the recent rise in world market prices for copper to historic highs. Non-traditional exports have also grown but their contribution to export earnings is dwarfed by that of metals. With mining output likely to slow over the next few years, following a period of rapid growth associated with the refurbishment of old mines and sustained investment in new ones, and the possibility that copper prices will retreat from current levels, Zambia's growth over the long-run will need to be supported by diversification non-traditional exports (IMF; 2006).

Given the foregoing, there is therefore need to establish whether depreciation impacts on non-traditional exports and imports (excluding inputs) in such a way that the BoP improves or worsens, so as to provide policy options that would help alleviate the problem.

1.3 Structure of Zambia's Trade Flows

Since 1964 Zambia's exports are largely dependent on the mining sector with copper and cobalt being the leading contributors to the export revenue. On the other hand, in most years, the largest contribution on the value of imports comes from petroleum products (crude oil). Thus, minerals (copper and cobalt in particular) are the traditional tradable export goods for Zambia while petroleum products are the major tradable import goods for Zambia.

To this effect, in this study, we did focus on non-traditional export goods whose demand is more likely to be dependent on the level of competitiveness since changes in traditional exports (copper and cobalt) and other metal products are less likely to be influenced by changes in competitiveness because of Zambia's affiliation to bilateral and multilateral trade agreements when selling these products. Consequently, traditional exports (copper and cobalt) and all metal exports are not included in the basket of goods for exports because they will tend to dominate the total value of exports whilst being unresponsive to changes in the REER.

Likewise, when coming-up with the basket for measuring imports, the study did focus on tradable imports excluding crude oil, which would tend to dominate. In this research, including crude oil (petroleum) needed not be the case because Zambia imports crude oil a bit more or less with the same quantities regardless of the changes in the level of competitiveness due to changes in nominal exchange rate or relative prices. This is because government usually intervenes in the petroleum market through stocking and off-loading. In the same vein, the basket for measuring imports did exclude fertilizer and metal imports (used as inputs) because changes in these imports are usually not necessitated by changes in the REER.

1.4 Objectives

1.4.1 General Objective

The main objective of this study was to establish if depreciation of Real Effective Exchange Rate (enhancing international price competitiveness of domestic goods)

improves the Balance of Payment for Zambia through growth in non-traditional exports and reduction in imports.

1.4.2 Specific Objectives

1) Ascertain if Zambia's non-traditional merchandise exports (exclusive of metal products) are responsive to changes in the real effective exchange rate;
2) Establish if imports (exclusive of fertilizer, metals and petroleum products) are responsive to changes in the real effective exchange rate;
3) Ascertain the extent to which non-traditional merchandise exports are dependent on the lagged values of imports for inputs (including only fertilizer, metal and petroleum products); and
4) Ascertain the extent to which merchandise imports (exclusive of fertilizer, metal and petroleum products) are dependent on the changes in income.

1.5 Hypotheses

1) In Zambia, depreciation in the national real effective exchange rate increases the real value of non-traditional merchandise exports (exclusive of metal products);
2) Depreciation in the national real effective exchange rate decreases the real value of national imports (exclusive of fertilizer, metal and petroleum products);
3) An increase in the real value of imported inputs (namely: petroleum, fertilizer and metal products) in the previous period will lead to an increase in the real value of non-traditional merchandise exports (exclusive of metal products) in the following period; and
4) An increase in national income increases the real value of imports (exclusive of fertilizer, metal and petroleum products) from the rest of the world.

1.6 Significance of the Study

According to traditional international trade theory, if each nation specializes in the production of the commodity of its comparative advantage, world output will be

greater and through trade each nation will share in the gain. With the present distribution of resources and technology between developed and developing nations, this theory prescribes that developing nations should continue to specialize primarily in the production and export of raw materials (such as fuels, minerals and food) to developed nations in exchange for manufactured products. This implies that long-term benefits from trade such as a wide industrial base, more trained labor force, more innovations, stable prices and higher income from trade, cannot accrue to developing countries unless deliberate policies aimed at promoting non-traditional exports are put in place.

Therefore, there is need to provide more evidence with latest data on how to strengthen and diversify exports for developing nations. This research is important because it has generated empirical evidence (from latest data) on the impact of REER depreciation on non-traditional exports and imports (exclusive of inputs), in Zambia. The evidence generated from this study has added information on policy implications of a depreciated REER with respect to non-traditional exports, imports and ultimately the BoP.

To my knowledge so far, there is no previous study that has used the SEECM and the Bewley Transformation Regression (herein used) to investigate the impact of REER depreciation on non-traditional exports and imports, for the short and long-run periods, respectively. Previous similar investigations have used other methods such as the ordinary ARDL and OLS to investigate the short and long-run effects of REER on trade flows. In this research, the SEECM and Bewley Transformation Regression were used so as to fill the lacunae that emanate from the use of other models such as the ordinary ARDL and OLS models, in previous similar studies.

CHAPTER 2

LITERATURE REVIEW

2 Theoretical and Empirical Literature

Orcutt (1950) theorized that trade flows of countries depend on changes in relative price. However, Houthakker and Magee (1969) augmented Orcutt's findings by stating that the income effects neglected in the model of the study were equally

important. The duo used a two-country model to prove that differences in income elasticities of the two counties' demand for imports chiefly influenced changes in the trade balance, even when production and prices were fairly constant (see appendix 1 for resulting models).

According to Oyinlola et al (2010), "The breakdown of the Bretton Woods system with the attendant emergence of floating exchange rate regimes altered the line of thought among economists, as the possibility of reversals in the trade balance owing to foreign exchange fluctuations became an important factor in the analysis of changes in trade flows."

Since the breakdown of the Bretton Woods system, economists have maintained that appreciation/ depreciation has great influence on countries' trade balances. However, Pilbeam (2006) argues that depreciation might work better, in improving the current account, for highly industrialized countries than developing countries. This is because many developing countries are heavily dependent on imports, and the price elasticity of demand for these imports are usually low, while industrialized countries which have to face competitive export markets, the price elasticity of demand for their exports may be quite elastic. It is on this basis that our research tried to establish whether Zambia's trade flows fall in the category of most developing countries, which do not respond to depreciation or not.

A consensus accepted by most economists is that elasticities are lower in the short-run than in the long run, in which case the Marshall-Lerner condition may not hold in the short-run but may hold in the medium to long-run (ibid). Goldstein and Kahn (1985) in a survey of the empirical literature conclude that, in general, long-run elasticities (more than two years) are approximately twice as great as short run elasticities (0-8 months) and because of this, short-run elasticities generally fail to sum to unity, while the long run can either sum to unity or fail. For this reason, in this research we will consider models that incorporate both the short and long-term analyses of Zambia's data on changes in trade flows vis-à-vis changes in the Real Effective Exchange Rate.

Currently, empirical results from time series econometrics have led to a reconsideration of some earlier statements in the theoretical literature on the behavior

of trade flows. In 2003, Bahmani-Oskooee and Kara investigated the behavior of trade flows in nine developed economies using stationary data within a cointegration and error-correction modelling framework and concluded, "There appears to be differential impacts on trade flows of changes in both exchange rate and relative prices which seem to reject Orcutt's original opinion". In their continued investigation, the duo obtained similar results using quarterly data on a sample of twelve developing countries over the periods of 1973 to 2002. The conclusion is that "It is clear that each country demonstrates different trade flow response path to changes in the relative prices and the exchange rate" (Bahmani-Oskooee, 2008).

According to Salvatore (2004) the movement from a fixed to a floating exchange rate system in the 1970's in most western countries after the breakdown of the Bretton Woods System stimulated a great resurgence of interest in the purchasing-power parity (PPP) theory[4] and led to numerous empirical studies to test the validity of the PPP theory.

One possible explanation given by Rogoff (1996) why exchange rates can move a great deal without triggering any immediate and large response in relative domestic prices (failure of the PPP theory within a decade) is that, despite all the globalization that has occurred during the past three decades, international markets are still much less integrated than national commodity markets. This is due to the existence of transportation costs, actual or threatened trade protection, information costs, and very limited international labor mobility.

Salvatore (2004) thus came to the following conclusions with regard to the empirical relevance of the PPP theory: Firstly, the PPP theory is expected to work well for highly traded individual commodities, such as wheat in the case of United States of America, but less well for all traded goods together and not so well for all goods (which include many non-traded commodities). Secondly, for any level of aggregation, the PPP theory works reasonably well over very long periods of time (many decades) but not so well over one or two decades, and not well in one decade. Thirdly, the PPP theory works well in cases of purely monetary disturbances and in

[4] The PPP theory asserts that nominal exchange rates adjust to offset changes in relative prices, so that REER can remain at a constant value in the long-run.

very inflationary periods but not so well in periods of monetary stability, and not well in situations of major structural changes.

Given the above conclusion on the PPP theory by Salvatore (2004), this research took into consideration the factors that would lead to the PPP theory holding and thus rendering the analysis of this research invalid. By so doing, this study was able to determine the impact of depreciating REER on exports, imports and ultimately the BoP, thereby achieving the objective of the study.

CHAPTER 3

METHODOLOGY

3.0 Overview

To achieve its objectives, the study used econometric regression analysis, on time series data, based on the theoretical framework (herein construed) taking into account the structure of Zambia's trade flows. To show how robust the results are, the researcher performed all the necessary diagnostic tests on all the models and all the diagnostic tests were confirming robustness in the study[5].

[5] See Diagnostic Tests on Appendix 3

3.1 Selection, Source and Management of Data

The study employed time series data from 2000q4-2011q4 with a view to minimizing the influence of political, cultural and social life changes on the economic variables under consideration since during this period there were negligible political, cultural and social life changes in Zambia. Further, to completely eliminate the argument for the PPP theory holding, which would render this research null and void if otherwise, the researcher purposefully chose the period 2000q4-2011q4 which is within the range of one decade, with no monetary disturbances and no hyper-inflation, which are some of necessary conditions required for the PPP theory to hold. Furthermore, it is important to state that conventionally, studies involving trade flows employ quarterly time series data, hence the use of quarterly data in this research.

The study used secondary data from the Bank of Zambia and the Central Statistical Office because of the availability and reliability aspects involved in sourcing for primary data of the variables under consideration.

The study made use of Excel and Stata (statistical computer programs) in the management and analysis of data.

3.2 Theoretical Framework

3.2.1 Theory

Basically, in trying to analyze the movements in the current account of the national Balance of Payment due to changes in the price competitiveness of a country relative to the rest of the world, economic theory entails the use of two models, namely, the export supply and the import demand models. In the two basic models, exports and imports are a function of Nominal Exchange Rate, Relative Prices and Income (Krugman and Baldwin; 1987).

However, in this research we did combine the effects of changes in Nominal Exchange Rate (NER) and changes in relative prices on trade flows, into one variable (the real exchange rate, RER) which reflects actual changes in the measure of price competitiveness as opposed to taking one factor at a time. The rationale behind this innovation hinges on the fact that both changes in nominal exchange rates and changes in relative prices have the same effects on the price competitiveness of domestic goods with respect to foreign goods and both improve the current account

by way of promoting export growth. In line with this innovation is the main objective of this research of trying to establish how enhanced price competitiveness (regardless of the source) of domestic goods relative to foreign goods improves Zambia's BoP, unlike considering individual effects of changes in exchange rate and relative prices, as is the case in the previous researches (e.g. that of Oyinlola et al; 2010). Thus, in this way, this research allowed us to draw policy implications of a real change in exchange rates by way of altering either nominal exchange rates or relative prices whilst keeping the other constant.

Furthermore, the advantage of using the RER concept is that it does also capture the effects of other factors on trade flows like closeness of the economy and excess supply of domestic credit (measured as the rate of growth of money supply minus the rate of growth of GDP) which also equally affect the international trade competitiveness of a country's exports by way of affecting the Relative Prices Mungule (2004).

Under normal circumstances (such as the Marshall-Lerner condition holding) the RER is hypothesized to impact on trade flows in such a way that a depreciated RER will tend to favor exports more than imports of goods and services and will also positively impact on domestic production and employment, whilst discouraging consumption of foreign goods (Mungule; 2004).

In support of the above supposition is the newly confirmed hypothesis that the behavior of the RER is inversely related to the behavior of purchasing power parity (PPP) theory. There is now a widespread agreement that there is no equilibrium value to which the RER for Sub-Sahara African countries tends to return despite the fact that NER and Relative Prices are related. In empirical studies done by Frenkel; 1981, Hakkio; 1986, Mark; 1990 the null hypothesis that RER follows a random walk process was not rejected. Thus, changes in the RER are permanent and should affect the pattern of trade flows in both the short and long-run.

Furthermore, regardless of whether the PPP theory exists or not, the argument that the PPP theory holds in this research is eliminated by using quarterly data on trade flows and exchange rates from 2000 to 2011 (one, and not many decades as required for the PPP theory to hold) during which period there were no monetary disturbance

and no hyper-inflation which are also some of the necessary conditions required for the PPP theory to hold as discussed in the last paragraph of the literature review.

In this research, weighted real exchange rate (REER) for major trading partners is used in preference to bilateral exchange rate (RER), so as to avoid the problem of the third country effect that arise when the latter is used. Mungule (2004) explained that "the multilateral real exchange rate (Real Effective Exchange Rate) is preferred to the bilateral Real Exchange Rate (RER) in the analysis because it takes into account the third country effects and that makes it a very good measure of a country's international price competitiveness".

In this study, we have also included an additional explanatory variable of imported inputs (IM) at lag (1), to the conventional export supply model. The rationale for this augmentation of the explanatory variable is that most inputs for Zambia's non-traditional exports (herein defined) are mainly imported and confirmed in advance of about 3 months or more. Thus, a change in the level of import value of these inputs in period t-1 with respect to period t-2 will directly affect the value of exports in period t. However, changes in these imported inputs (IM_{t-1}) are less likely to be dependent on the changes in the REER because during the period 2000-2011 government usually intervened in the markets of these products by way of subsidizing and stocking (or off-loading) of the main inputs as discussed in 1.4 above. Therefore, the inclusion of the variable (IM_{t-1}) to the base-line export model will not cause collinearity with REER in our regression results because IM_{t-1} is comprised of petroleum, fertilizer and metal products which are not responsive to REER;

Having deliberated on the theoretical framework that has guided this research, in the next section we present the culminating trade flow models.

3.2.2 Trade Flow Modeling

The export supply and import demand models that we used in this research to estimate changes in the trade flows are augmentations to the conventional Models developed by different researchers. The models herein used have been tailored to

suite the Zambian case based on the structure of Zambia's trade flows and the subsequent theory above[6].

3.2.2.1 Export Supply Model

$$\boldsymbol{ln\,(ex)_t = a_0 + a_1 ln(REER)_t^{ex} + a_2\, ln(wi)_t + a_3 ln(IM)_{t-1} + V_t} \ldots\ldots (1)$$

ln is the natural log; variables are expressed in their natural log form because in a log-linear regression function a one percent change in the independent variable, directly approximates a percent change in the dependent variable which is given by the value of the respective coefficient of the independent variable.

a_0>0, a_1>0, a_2>0, a_3>0; where

ex_t is the real value of Zambia's non-traditional merchandise exports (herein defined as all exports excluding those from the metal sector) expressed in kwacha for period t;

a_0 is a constant term representing the value of non-traditional exports not dependent on any explanatory variable;

$REER^{ex}$ is the real effective exchange rate index (where 2006Q1=100) calculated using rates reported by the Bank of Zambia;

wi is the weighted income of major destination countries for Zambia's exports which proxy is the Zambia's real value of total exports;

IM_{t-1} is the real value of imports for inputs (including only petroleum, fertilizer and metal products) in the previous period with respect to t,

V_t is the error term.

3.2.2.2 Import Demand Model

[6] See appendix 1 for baseline models developed by Krugman and Baldwin (1987), Rose and Yellen (1989), Rose (1991), Baharumshah (2001) and Khan and Hossain (2010).

$$\boldsymbol{ln(im)_t = b_0 + b_1 ln(REER)_t^{im} + b_2\ ln(Zi)_t + U_t} \ldots\ldots\ldots (2)$$

$b_0 > 0, b_1 < 0,\ b_2 > 0$; where

$(\mathrm{im})_t$ is the real value of Zambia's merchandise imports (excluding petroleum, fertilizer and metal products) expressed in kwacha for period t;

b_0 is the constant term representing the value of imports not dependent on any explanatory variable;

$REER^{im}$ is the real effective exchange rate which proxy is the REER calculated by the BoZ;

$(\mathrm{zi})_t$ is real Zambia's national income in period t which proxy is the total value of Zambia's imports in the BoP as compiled by the BoZ. In this case, movements in Zambia's total income are hypothesized to mimic movements in Zambia's total imports from the rest of the world. In other words, our core assumption is that for each period t, Zambia's national income is directly and positively related to the value of total imports which are given in the national BoP by BoZ on a quarterly basis; and

U_t is the error term.

3.3 Definition and Measurement of REER

3.3.1. Functional Definition for REER

The standard approach for defining REER is to express the theoretical relationship between the REER and its important real variables that determine its movements. In his study, Mungule (2004) adopted the following functional relationship to define REER for a country with an economic structure like that of Zambia.

REER = f (NOMDEP^{+}, TOT$^{+/-}$, CLOSE^{-}, CAPIN^{-}, EXCRE^{-})……. (3)

Where,

NOMDEP is the nominal depreciation, which is the growth rate in nominal effective exchange rate.

TOT is the external terms of trade, defined as the ratio of weighted foreign import price for Zambia to foreign price of exportable goods (foreign price for exports).

CLOSE is defined by [Y/(X+M)], which is the ratio of GDP (Y) over the sum of Exports (X) and Imports (M). This is used as a proxy for policies affecting trade in general. An increase in this ratio indicates an increase in closeness of the economy.

CAPIN is the capital inflow, measured as the difference between net change in reserves and trade balance scaled by GDP.

EXCRE is the excess supply of domestic credit measured as the rate of growth of money supply minus the rate of growth of GDP. This assumes that the demand for domestic credit has a unitary elasticity with respect to real income. The effect of excess domestic credit, which captures the influence of over expansionary macroeconomic policies, is that it induces the influence of inflation in the model and hence depreciates the REER.

3.3.2 Ideal Measurement of REER

Ideally, in this research, the measurement of REER would have been done in two forms. The first one (REER for exports) would have been derived using the trade weights for major destination countries for Zambia's exports while the second (REER for imports) would have been derived using trade weights for major exporting countries to Zambia[7]. The two would have been derived based on the real exchange rate equation, given by:

$$\boldsymbol{RER = PT/PN} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

Where,

[7] The Ideal Measurement of REER was motivated by Mungule (2004) measurement of REER. See Apendix 5

RER is the real exchange rate and PT and PN are the domestic price indexes for tradable goods and non-tradable goods, respectively. Thus, three proxies would have been used in an operational definition for RER for country *i*, as follows:

$$\boldsymbol{RER_i = (E_i.FPT)/PN} \quad \text{..... (5)}$$

Where,

RER_i($BRER_i$) is the bilateral real exchange rate index with countryi,

E_i is the nominal exchange rate measured in terms of Zambian kwacha per unit of country i's currency in period t.

FPT is the foreign currency price of tradable goods, approximated by a weighted foreign price index for export goods FPT^{ex} and weighted foreign import price index FPT^{im}.

PN is as defined above and approximated using Zambia consumer price index (CPI).

Empirical calculation for indexes:

$$\boldsymbol{BRER^{ex}_{FPT} = (E_i . FPT^{ex})/CPI} \quad \text{..... (6)}$$

Where,

$BRER^{ex}_{FPT}$is the bilateral RER index calculated using weighted foreign price index for export goods; and

$$\boldsymbol{BRER^{im}_{FPT} = (E_i . FPT^{im})/CPI} \quad \text{..... (7)}$$

Where,

$BRER^{im}_{FPT}$is the bilateral RER index calculated using Zambia's weighted foreign import price index as a proxy for foreign prices of tradable imports.

The real effective exchange rate (REER) indexes would have been calculated using trade weights for six major trading partners by multiplying the bilateral real exchange rates with the trade weights and summing the products as follows:

REER for Exports

$$\boldsymbol{REER^{ex} = BRER_1^{ex}W_1 + BRER_2^{ex}W_2 + \ldots + BRER_6^{ex}W_6} \ldots\ldots\ldots\ldots \quad (8)$$

Where,

$REER^{ex}$is the real effective exchange rate index based on weighted foreign price index for export goods;

$W_{i'}$s are trade weights for countries 1,2...6 which are major importers of Zambia's exports;

REER for Imports

In the same vein, the REER for imports would have been:

$$\boldsymbol{REER^{im} = BRER_1^{im}W_1 + BRER_2^{im}W_2 + \ldots + BRER_6^{im}W_6} \ldots\ldots\ldots\ldots\ldots \quad (9)$$

Where,

$REER^{im}$is the real effective exchange rate index based on weighted foreign import price;

$W_{j'}$s are trade weights for countries 1,2...6 from which Zambia's major imports come from;(Mungule, 2004).

However, due to limited resources to calculate the two REER's ideal for this research as envisaged, we used the REER published by the BoZ, as a proxy for $REER^{im}$ and $REER^{ex}$.

3.4 Econometric Framework

3.4.1 Error Correction Models

Using time series data to study the responsiveness of exports and imports (trade flows) to changes in the Real Effective Exchange Rate involves deeper analysis of dynamic adjustments in the nature of export supply and import demand models because the use of conventional Ordinary Least Squares (OLS) estimation gives spurious and misleading results. This is usually because of the phenomenon of non-stationary trends in time series variables and the existence of cointegration for some of the variables in certain circumstances.

Consequently, testing for the order of the level of integration and cointegration has become a standard norm in applied econometric researches. There are basically two motives why econometric researchers test for integration and cointegration.

The first motive, which is not applicable to this research, is to know the order of integration for setting up an econometric model and thereafter make inferences. In this situation, it is required to perform very detailed tests, and take great care in finding exact critical values.

The second motive (which is applicable in this research) is that economic theory suggests that certain variables should be integrated or a random walk. In this case, unit root tests are mainly a descriptive tool performed to classify series as stationary or non-stationary.

Since integration and cointegration phenomena yield spurious results if not treated as such, researchers such as Bahmani-Oskooee and Kara (2008) and Oyinlola et al (2010) have employed Auto-Regressive Distributed Lag (ARDL) models recommended by Pesaran et al (2001) to investigate the responsiveness of trade flows to changes in exchange rates. The use of the ARDL model in these similar studies, in preference to other dynamic models such as the Vector Error Correction Model, has been particularly successful because there is no theory or empirical evidence that suggests *granger* causality (endogeneity) among variables in trade flow models.

Likewise, in this study, in an effort to conduct an analysis of dynamic adjustments of trade flows, we did apply the Single Equation Error Correction Model (SEECM), as recommended by Sjo (2008), and this was proved to be equivalent to the ARDL model by Best (2008).

According to Sjo (2008) "a pragmatic approach to studying dynamic models is to use a priori information to estimate an error correction mechanism first, and then include it in an equation of variables which are in the first difference form." The error term ($\hat{e}_{t-1}$), calculated from a static OLS model, should be used as an error correction mechanism in the SEECM.

Further, the lag length of differenced variables in the SEECM was chosen (as recommended by Sjo; 2008) such that the error term U_t of the SEECM, is closest to being normally and independently distributed in the set of error terms obtained using different lag lengths (refer to the appendix for the diagnostic tests of this condition for both SEECMs).

In the SEECM, the error correction term ($\hat{e}_{t-1}$) is the only potential I(1) variable, assuming that other variables become stationary in their first differences. In this connection, "since the remaining variables in the SEECM are assumed to be all I(0), their distribution are not affected by the presence of $\hat{e}_{t-1}$ even if this tested non-stationary of order 1, and therefore there is no harm, in terms of spurious results, done by including the error correction term, which cannot bring about spuriousness", (*ibid*). Further, Sjo (2008) advises that this realistic approach should be motivated by strong a priori information about the long-run relationship of variables, and that it is better to have some representation of the long-run adjustment in the model than not have, since it does not cause any spuriousness. In this regard, under the SEECM, compared to other models, the test for cointegration is merely for clarification of a priori information purposes but not that it is necessary for modelling. In this case, the test statistic of the coefficient for the error correction terms ($\hat{e}_{t-1}$) in the SEECM's, will be closer to the normal distribution table than the Dickey-Fuller table. Thus, the normal distribution test, at 1 percent significance level, is a better test for cointegration testing given the above assumptions on stationarity hold (*ibid*).

Below are the culminating Error Correction Models from the above discussion.

3.4.1.1 SEECM for Export Supply

$$\Delta ln(ex)_t = a_0 + a_1[ln(ex)_{t-1} - a_1 ln(REER)_{t-1} - a_2 ln(wi)_{t-1} - a_3 ln(IM)_{t-2}] + \sum_{i=1}^{p} a_{5i}\Delta ln(ex)_{t-i} + \sum_{i=1}^{q} a_{6i}\Delta ln(REER)_{t-i} + \sum_{i=1}^{r} a_{7i}\Delta ln(wi)_{t-i} + \sum_{i=2}^{s+1} a_{8i}\Delta ln(IM)_{t-i} + W_t \dots\dots\dots\dots (10)$$

Where all variables are defined as in 3.2.2.1 above and$\Delta$is the first difference notation;

Let

$$\boldsymbol{ln(ex)_{t-1} - a_1 ln(REER)_{t-1} - a_2 ln(wi)_{t-1} - a_3 ln(IM)_{t-2} = \widehat{V}_{t-1}} \ldots\ldots\ldots\ldots (11)$$

Therefore, for the purpose of regression operations in Stata, we can re-write the above SEECM as:

$$\begin{aligned}\Delta \mathbf{ln}(\boldsymbol{ex_t}) = \boldsymbol{a_0} &+ \boldsymbol{a_1}\widehat{\boldsymbol{V}}_{\boldsymbol{t-1}} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p}} \boldsymbol{a_{5i}} \Delta \mathbf{ln}\,(\boldsymbol{ex})_{\boldsymbol{t-i}} \\ &+ \sum_{\boldsymbol{i=1}}^{\boldsymbol{q}} \boldsymbol{a_{6i}} \Delta \boldsymbol{ln}\,(\boldsymbol{REER})_{\boldsymbol{t-i}} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{r}} \boldsymbol{a_{7i}} \Delta \boldsymbol{ln}\,(\boldsymbol{wi})_{\boldsymbol{t-i}} + \sum_{\boldsymbol{i=2}}^{\boldsymbol{s+1}} \boldsymbol{a_{8i}} \Delta \boldsymbol{ln}(\boldsymbol{IM})_{\boldsymbol{t-i}} \\ &+ \boldsymbol{W_t} \ldots\ldots\ldots\ldots\ldots\ldots (12)\end{aligned}$$

3.4.1.2 SEECM for Import Demand

$$\begin{aligned}\Delta \mathbf{ln}\,(\boldsymbol{im})_{\boldsymbol{t}} = \boldsymbol{b_0} + \boldsymbol{b_1}[&\mathbf{ln}\,(\boldsymbol{im})_{\boldsymbol{t-1}} \\ &- \boldsymbol{b_2 ln(REER)_{t-1}} - \boldsymbol{b_3}\, \boldsymbol{ln(zi)_{t-1}}] + \sum_{\boldsymbol{i=1}}^{\boldsymbol{j}} \boldsymbol{b_{4i}} \Delta\, \boldsymbol{ln(im)_{t-i}} \\ &+ \sum_{\boldsymbol{i=1}}^{\boldsymbol{k}} \boldsymbol{b_{5i}} \Delta\, \boldsymbol{ln(REER)_{t-i}} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{l}} \boldsymbol{b_{6i}} \Delta \boldsymbol{ln(zi)_{t-i}} + \boldsymbol{\epsilon_t} \ldots\ldots\ldots (13)\end{aligned}$$

Where all variables are defined as in 3.2.2.2 above we can let

$$\mathbf{ln}\,(\boldsymbol{im})_{\boldsymbol{t-1}} - \boldsymbol{b_2 ln(REER)_{t-1}} - \boldsymbol{b_3}\, \boldsymbol{ln(zi)_{t-1}} = \widehat{\boldsymbol{U}}_{\boldsymbol{t-1}} \ldots\ldots\ldots\ldots (14)$$

In the same vein, for the sake of regression operations in Stata we can re-write the above SEECM as:

$$\Delta \boldsymbol{ln}(\boldsymbol{im})_{\boldsymbol{t}} = \boldsymbol{b_0} + \boldsymbol{b_1}\widehat{\boldsymbol{U}}_{\boldsymbol{t-1}} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{j}} \boldsymbol{b_{4i}} \Delta\, \boldsymbol{ln}(\boldsymbol{im})_{\boldsymbol{t-i}} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{k}} \boldsymbol{b_{5i}} \Delta\, \boldsymbol{ln}(\boldsymbol{REER})_{\boldsymbol{t-i}} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{l}} \boldsymbol{b_{6i}} \Delta \boldsymbol{ln}(\boldsymbol{zi})_{\boldsymbol{t-i}} + \epsilon_{\boldsymbol{t}} \dots\dots\dots\dots (15)$$

The portions of the general SEECM equations in the rectangular parentheses are the error correction mechanisms $\widehat{\boldsymbol{V}}_{\boldsymbol{t-1}}$and $\widehat{\boldsymbol{U}}_{\boldsymbol{t-1}}$for the two SEECMs respectively. It requires that the error correction terms equal to zero, when the dependent variables and their respective vectors of predictors are in their equilibrium state;

Coefficients on differenced predictor variables estimate the short term effect of an increase in the predictor on the dependent variable;

The coefficients of the error correction terms estimate the speed of return to long-run equilibrium after a deviation due to a change in the short-term;

If the ECM approach is appropriate for both models, then -1 $< \boldsymbol{a_1} <$ 0 and -1 $< \boldsymbol{b_1} <$ 0; and the number of lags in respective SEECMs is chosen such that the errors $\boldsymbol{W}$ and $\boldsymbol{\epsilon}$ are closest to being normally and independently distributed.

Coefficients on the lagged explanatory variables in the rectangular parentheses estimate the long term effect (correction) that a 1 percent increase in the independent variable has on the dependent variable. This long term effect (correction) will be distributed over future time periods according to the rate of error correction terms $\boldsymbol{a_1}$and $\boldsymbol{b_1}$respectively.

3.4.1.3 Long-run Modeling Using the Bewley Transformation

In general, let us represent the above two SEECM's as:

$$\boldsymbol{\Delta Y_t} = \boldsymbol{\gamma_0} + \boldsymbol{\gamma_{i,1}} \sum \boldsymbol{\Delta X_{i,t}} + \boldsymbol{\gamma_{i,2}} \left(\boldsymbol{Y_{t-1}} - \boldsymbol{\gamma_{i,3}} \sum \boldsymbol{X_{i,t-1}} \right) + \mu_{\boldsymbol{t}} \dots\dots\dots\dots (16)$$

The general function for which Y and X are in their long term equilibrium is given by:

$$\boldsymbol{Y_t} = \boldsymbol{k_0} + \boldsymbol{k_{i,1}}\sum \boldsymbol{X}_{\boldsymbol{i,t}} \ldots\ldots\ldots (17);$$

Where $k_0 = \frac{\gamma_0}{\gamma_{i,2}}$ and $k_{i,1} = \frac{\gamma_{i,3}}{\gamma_{i,2}}$

Where $k_{i,1}$ is the total long term effect of X on Y (called the long-run multiplier) distributed over future time period. The Bewley Transformation Regression method is particularly useful for allowing us to estimate $k_{i,1}$'s standard errors, and therefore obtain non-spurious test statistics for the long-run coefficients as recommended by Best (2008), given that the OLS method yields spurious statistical tests that we cannot rely on for inferences.

The Bewley Transformation Regression method for obtaining non-spurious long-run test statistics entails the following procedure, Best (2008):

1. Estimating ΔY_t by carrying out the regression function:

$$\boldsymbol{\Delta Y_t} = \boldsymbol{a} + \boldsymbol{bY_{t-1}} + \boldsymbol{c_i}\sum \boldsymbol{X_{i,t-1}} + \sum \boldsymbol{\Delta X_{i,t}} + \epsilon_{\boldsymbol{i,t}} \ldots\ldots\ldots\ldots (18)$$

2. Taking the predicted values of ΔY_t and using them to estimate the long-run function given by:

$$\boldsymbol{Y_t} = \boldsymbol{m} + \boldsymbol{k_{i,1}\Delta Y_t} + \boldsymbol{k_{i,2}}\sum \boldsymbol{X_{i,t}} - \boldsymbol{k_{i,3}}\sum \boldsymbol{\Delta X_{i,t}} + \boldsymbol{v_{i,t}} \ldots\ldots\ldots\ldots (19)$$

According to Best (2008) this regression function will enable us to obtain non-spurious statistical tests (standard errors) for regression functions in their long-term equilibrium state as opposed to carrying out the Ordinary Least Squares regression function. The commensurate coefficients obtained using the Bewley Transformation Regression method and those obtained in the OLS method will be approximately equal but with different standard errors). The equality of coefficients in the two methods will be brought about because in the Bewley Transformation Regression method, changes in the dependent variable (ΔY) and net changes in the explanatory variables $(\sum \Delta X)$ will be

approximately equal, given the long term equilibrium state is attained, such that$\Delta Y \approx \sum \Delta X$. Therefore, the estimated long-run Bewley Transformation regression model will in essence reduce to the form $Y_t = k_0 + k_{i,1}\sum X_i$which is the long-term equilibrium regression function estimated in the OLS method but with different test statistics.

CHAPTER 4

EMPIRICAL RESULTS

4.0 Overview

It is important to state that in this study we used proxies for certain explanatory variables and that the measurement of the principal explanatory variables ($REER^{ex}$ and $REER^{im}$) in the two models was not based on the ideal notion, with regard to the objective(s) of the study. Therefore, to avoid ambiguity in the rejection criteria among the three conventional levels (1, 5 and 10 percent), all the tests were concluded on none stringent basis, such that when the null hypothesis in a particular test is desirable with regard to the research hypothesis, we rejected it if, and only if, it is significant at 1 percent level. In the same vein, when the null hypothesis in a particular test is undesirable with regard to the research hypothesis, we rejected it if, and only if, it is significant at 10 percent level. In other words, in this research none stringent rules for conclusion in a statistical test entail widening the acceptance region for desirable hypotheses to 99 percent and reducing the acceptance region for undesirable hypotheses to 90 percent.

4.1 Unit Root Tests

Table 1 below shows the unit root test results for all variables in the export and import models herein used.

Table1: Unit Root Tests

variables	Non-Differenced Z(t) {P-Values}		Differenced (1) Z(t) {P-Values}	
	Dickey-Fuller	Philip-Perron	Dickey-Fuller	Philip-Perron
$(ex)_t$	-2.342 {0.1587}	-1.852 {0.3552}	-7.648 {0.0000***}	-9.467 {0.0000***}
$(REER)_t$	-1.517 {0.5250}	-1.627 {0.4692}	-4.708 {0.0001***}	-4.629 {0.0001***}
$(wi)_t$	-0.917 {0.7822}	-0.674 {0.8533}	-7.189 {0.0000***}	-7.432 {0.0000***}
$(IM)_{t-1}$	-2.748 {0.0660*}	-2.617 {0.0894*}	-10.415 {0.0000***}	-12.133 {0.0000***}
$(im)_t$	-2.783 {0.0607*}	-2.577 {0.0979*}	-10.016 {0.0000***}	-12.283 {0.0000***}
$(zi)_t$	-1.261 {0.6470}	-0.691 {0.8491}	-8.452 {0.0000***}	-9.219 {0.0000***}

The null hypotheses for all the tests are that there is a unit root (i.e. the variable is non-stationary); (***) implies significance at 1, 5 and 10 percent, (**) significance at 5 and 10 percent and (*) significance at 10 percent only.

The table above summarizes the results of the Dickey Fuller and the Phillip Perron unit root tests for both the export supply and the import demand models. The variables im and IM are integrated of order 0 i.e. I(0) and the variables ex, REER, wi

and zi are integrated of order 1 i.e. I(1). This is evidenced in their respective probability values which are all highly significant at all conventional levels of significance at first difference. In this accord, the results therefore imply that the Single Equation Error Correction Modelling approach can be applied in this study since none of the variables are integrated of order higher than 1.

4.2 Export Supply Models

(a) Short-Run Results based on the SEECM

Table 2: Export Short-Run Regression Results

Regression results for $\Delta ln[\text{ex}]_t$			
Variables	Coefficient	t-statistic	p-value
$\widehat{V}_{t-1}$	-0.807593	-4.08	0.000***
$\Delta ln(\text{ex})_{t-1}$	0.1908135	1.52	0.138
$\Delta ln(\text{REER})_t$	1.032086	3.18	0.003***
$\Delta ln(\text{wi})_t$	0.6729808	4.38	0.000***
$\Delta ln(\text{IM})_{t-1}$	0.2143458	2.32	0.026**
Constant	0.0013825	0.06	0.952
Adjusted R-Squared		0.5365	

Based on the results in the table above, the export ECM is:

$$\Delta \mathbf{ln}(\boldsymbol{ex})_t = -\mathbf{0.81}\widehat{\boldsymbol{V}}_{\boldsymbol{t-1}} + \mathbf{0.19}\Delta \boldsymbol{ln}(\mathbf{ex})_{t-1} + \mathbf{1.03}\Delta \boldsymbol{ln}\,(\boldsymbol{REER})_t + \mathbf{0.67}\Delta \boldsymbol{ln}\,(\boldsymbol{wi})_t + \mathbf{0.21}\Delta \boldsymbol{ln}(\boldsymbol{IM})_{t-1} + \boldsymbol{W_t} \ldots\ldots\ldots\ldots (20)$$

The table above shows the short-run results of the export supply SEECM. The results show that the error correction term $\widehat{V}_{t-1}$ is sufficiently significant which validates the assumption of cointegration in the variables under consideration.

Further, the results show that the sign for the error correction term is negative and that the term is between 0 and -1 which confirms that the model being used is the right one and conforms to the requirements of a SEECM. The error correction term of -0.807593implies that, according to this model, whenever there is any deviation from the static equilibrium, the deviation must be corrected at a rate of about 81 percent, with the correction distributed in future quarters. (Notice that, the larger the magnitude of the error correction term coefficient is, the faster the speed of adjustment towards the equilibrium).

Coming to the REER, which is the variable of core interest, as far as the study is concerned, our expectations were also met. The results show that the coefficient for the REER is highly significant at all conventional levels of significance. The REER coefficient of approximately 1.03 implies that for a 1 percent increase (depreciation) in the Real Effective Exchange Rate of the Kwacha, in a particular quarter (in the short-run), non-traditional exports will increase by 1.03 percent. To this end, we can confidently confirm that in the short-run, the theoretical hypothesis which postulates that in Zambia, depreciation in the Real Effective Exchange Rate increases the value of non-traditional merchandise exports is valid.

Like REER, the third variable wi (weighted income for major importers of Zambia's non-traditional exports) is highly significant at all conventional levels. The wi coefficient of about 0.67 implies that for a 1 percent change in the real value of weighted income, Zambia's real value of nontraditional exports will increase by about 0.67 percent. Put differently, this implies that a 10 percent increase in the real foreign weighted income will necessitate a 6.7 percent increase in the real value of nontraditional exports. However, as far as policy analysis on the national level is concerned, this variable is not in our interest because it is outside the domain of national macroeconomic policy makers. Its inclusion in the study is purely for econometric purposes so that we do not have an error in the model specification due to omission of some variable(s).

Another variable of interest for policy analysis at the national level is IM, which is the real value of imported inputs in the immediate past quarter. Unlike the REER and the wi variables, the IM (imported inputs) variable is fairly significant at only 5 and 10 percent levels of significance. A 0.2143458 coefficient implies that for a 10 percent change in the real value of imported inputs, nontraditional exports will increase by about 2.14 percent in real terms. In this regard, we can conclude that in the short run, we can be 95 percent confident to say that the hypothesis which postulates that in Zambia, an increase in imported inputs (petroleum, fertilizer and metal products) in the previous period will lead to an increase in the real value of non-traditional merchandise exports (exclusive of metal products) in the following period.

Finally, the adjusted R-squared of about 54 percent, implies that in the short run, the explanatory variables under consideration in the model account for about 54 percent changes that take place in non-traditional exports (ex).

(b) Long-run Results based on the Bewley Transformation

Table 3: Export Long-Run Regression Results

Regression results for $ln(\text{ex})_t$ based on the Bewley Transformation			
Variable	Coefficient	t-statistic	p-value
$ln(\text{REER})_t$	0.7874133	4.67	0.000***
$ln(\text{wi})_t$	0.6205802	6.53	0.000***
$ln(\text{IM})_{t-1}$	0.1631707	1.36	0.183
Constant	-3.38669	-2.12	0.041**
Adjusted R-Squared		0.6182	

Based on the results in the table, the export long-run equation is:

$$\boldsymbol{ln(ex_t) = -3.39 + 0.79\, ln(REER)_t^{ex} + 0.62\, ln(wi)_t + 0.16\, ln(IM)_{t-1} + V_t} \ldots\ldots (21)$$

The table above shows the long-run results of the export supply model obtained using the Bewley's transformation. The constant term is significant at 95 percent level, with an unanticipated negative sign which is counter intuitive. However, an in-depth analysis would explain that the negative sign result stems from the fact that the exports under consideration are non-traditional meaning that without the influence of exchange rates and foreign income (i.e. *ceteris paribus*), given the current technology and resources, Zambia would be an importer of non-traditional exports (herein defined by ex) hence the negative sign of the coefficient. Therefore, based on the results of a negative constant, one is justifiable to conclude that Zambia has an inferior technology and absolute disadvantage in the aggregate production of non-traditional exports (ex).

Further, the results show that in the long-run, REER and weighted foreign income (wi) are highly significant with coefficients of 0.7874133 and 0.6205802 respectively. Thus in the long-run, the research hypothesis for REER will hold.

In the case of the imported inputs (IM) variable it is highly insignificant (unlike in the short-run where it is significant at 95 percent level) meaning that in the long-run the research hypothesis of imported inputs will be rejected implying that in the long-run imported inputs will not have any salient impact on the real value of non-traditional exports (herein defined).

In the long-run model, the Adjusted R-Squared is 0.62 implying that the explanatory variables under consideration account for about 62 percent of changes in the non-traditional exports.

4.3 Import Demand Models

(a) Short-Run Results based on the SEECM

Table 4: Import Short-Run Regression Results

Regression results for $\Delta ln[\text{im}]_t$

Variables	Coefficient	t-statistic	p-value
$\widehat{U}_{t-1}$	-0.8758232	-3.83	0.001***
$\Delta ln(\text{im})_{t-1}$	-0.0514773	-0.27	0.790
$\Delta ln(\text{REER})_{t}$	0.0129715	0.04	0.970
$\Delta ln(zi)_{t}$	1.228334	6.89	0.000***
$\Delta ln(\text{im})_{t-2}$	0.0795942	0.72	0.478
$\Delta ln(\text{REER})_{t-1}$	-0.6037617	-1.70	0.098*
$\Delta ln(zi)_{t-1}$	0.2299449	0.86	0.397
Constant	-0.0145705	-0.64	0.526
Adjusted R-squared		0.6815	

Based on the results in the table, the Single Equation Error Correction Model for imports is:

$$\Delta \boldsymbol{ln(im_t)} = -\mathbf{0.01} - \mathbf{0.88}\widehat{\boldsymbol{U}}_{\boldsymbol{t-1}} - \mathbf{0.05}\Delta \boldsymbol{ln(im)_{t-1}} + \mathbf{0.07}\Delta \boldsymbol{ln(im)_{t-2}} + \mathbf{0.01}\Delta \boldsymbol{ln(REER)_t} - \mathbf{0.60}\Delta \boldsymbol{ln(REER)_{t-1}} + \mathbf{1.23}\Delta \boldsymbol{ln(zi)_t} + \mathbf{0.23}\Delta \boldsymbol{ln(zi)_{t-1}} + \boldsymbol{\epsilon_t} \ldots\ldots\ldots\ldots (22)$$

The table above shows the short-run results of the import demand SEECM. The results show that the error correction term is sufficiently significant which validates the assumption of cointegration in the variables under consideration.

Further, the results show that the sign for the error correction term is negative and that the term is between 0 and -1 which confirms that the model being used conforms to the requirements of a SEECM. The error correction term of -0.8758232 implies that, according to this model, whenever there is any deviation from the static equilibrium, the deviation must be corrected at a rate of about 88 percent, with the correction distributed in future quarters.

In the short-run model, changes in the REER of the current quarter do not significantly account for changes in imports (herein defined) as evidenced by the p-value which is highly insignificant. In this regard, it is worth noting that even though the hypothesis suggested by theory does not hold in the first quarter, this is not surprising because of the phenomenon known as the J-Curve effect.

The J-Curve effect is simply the lagged influence of changes in exchange rate, on the quantity of imports. The main reason behind this is that even though we have excluded (petroleum, fertilizer and metal products) in the definition of imports, there are still other investment goods which are usually imported on the basis of contracts, accounting for a large proportion of our imports (herein defined). Consequently, for investment goods, importers do not instantly change their behaviour towards the demand for imports even though prices change due to real depreciation or appreciation.

Coupled to the adverse effect of the J-Curve trend stemming from contracts is the fact that imports are, in most cases, confirmed in advance of roughly about not less three months. Therefore, in the first quarter, the real depreciation of the exchange rate does not cause the expected reduction in the real value of imports and instead, this is accompanied by an increase in imports since the real value of the existing import continues to grow at a rate of 1.3 percent despite a real depreciation of 10 percent since imports were confirmed way back. It is because of these mechanisms that an adverse effect, on the hypothesized expectations of depreciation with respect to imports, in the present quarter, is experienced.

However, the J-Curve effect merely stems from a temporal structural characteristic of trade patterns that causes the demand for imports to be non-responsive within three months of the effected change in the exchange rate. As observed, the REER coefficient in the previous quarter (t-1) becomes fairly significant at 90 percent confidence interval, with a postulated negative sign in the hypothesis, implying that within six months, importers begin to respond to changes in the real exchange rate. Additionally, the adverse influence, on imports vis-à-vis depreciation, from previous "future purchases" and contracts fades away in the second quarter thereby increasing the responsiveness of imports from 0.13 percent to 6.04 percent for 10 percent change in the REER with the anticipated negative sign.

Another variable of interest for the short-run analysis is zi, which is the real value of Zambia's income in a particular quarter. In this model, unlike the REER, zi is highly significant at all conventional levels in the first quarter and has the predicted sign. Economically and intuitively, this is appealing because changes in the real value of income are expected to instantly and positively impact on the real value of imports. In this case, we have a 1.23 coefficient which implies that for a 1 percent change in the level of income imports (excluding petroleum, fertilizer and metal products) will increase by about 1.23 percent. In this regard, we can conclude that in the short run, we can be 99 percent confident to say that the hypothesis which postulates that, in Zambia an increase in national income increases the real value of imports (exclusive of fertilizer, metal and petroleum products) from the rest of the world cannot be rejected.

The constant term in the model is sufficiently insignificant and therefore does not attract any economic discussion.

(b) Long-run Results based on the Bewley Transformation

Table 5: Import Long-Run Regression Results

Regression results for $\ln[im]_t$ based on the Bewley Transformation			
Variables	Coefficient	t-statistic	p-value
$\ln (REER)_t$	0.3143675	2.76	0.009***
$\ln (zi)_t$	1.118085	9.06	0.000***
Constant	-3.016095	-2.21	0.033**
Adjusted R-squared		0.7172	

Based on the results in the table above, the long-run import equation is:

$$\boldsymbol{ln(im)_t = -3.02 + 0.31ln(REER)_t^{im} + 1.12\ ln(Zi)_t + U_t} \ldots\ldots\ldots (23)$$

The table shows the long-run results of the import demand model obtained from the SEECM using the Bewley's transformation. The constant term is significant at 95 percent level, with an unanticipated negative sign which is again counter intuitive as is the case in the long-run export model. Analogously, the in-depth analysis for a negative sign in this case would be that assuming *ceteris paribus* i.e. keeping REER and zi constant, Zambia would be a net exporter of merchandise imports.

Further, the results show that in the long-run, REER and wi are highly significant with the coefficients of 0.3143675 and 1.118085 respectively. However, for the REER variable, despite the coefficient being significant, the hypothesis that in Zambia, depreciation in the Real Effective Exchange Rate decreases the real value of national imports (exclusive of fertilizer, metal and petroleum products) is defied because of the positive sign of the coefficient. In this case, surprisingly and counter-intuitively, the data used in this research suggest that in Zambia, in the long-run, depreciated REER necessitates a rise in imports (im).

However, this phenomenon stems from the fact that in the basket of imports under consideration, despite removing fertilizer, petroleum and metal products on the account of being non-responsive to REER, the remaining imports are also potentially non-responsive (but difficult to isolate all non-responsive goods because of the way the BoP is reported) to changes in exchange rates. In the basket of imports under consideration goods such as motor vehicles and other machines which are not domestically produced are included. However, such goods ought not to be responsive to changes in the REER, because no matter how expensive these goods become, due to depreciation, they cannot be replaced by domestic goods which are non-existent and therefore will continue to grow given income grows. In this regard, provided income is rising at a faster rate than that of REER (depreciation), one expects that imports will increase despite REER growing hence the adverse effect experienced in this case. However, a short-run conformity that has been suggested by our data at lag

1 of REER can be explained as an "adjustment effect" on the behavior of importers who temporarily respond to depreciation by reducing consumption of imports but do not find alternatives.

In the case of zi (real national income), the variable is highly significant and maintains the predicted positive sign implying that in the long-run we cannot reject the hypothesis that in Zambia, an increase in real national income increases the real value of imports from the rest of the world.

In the long-run model, the Adjusted R-squared is about 0.72 implying that in the long-run, the explanatory variables under consideration account for about 72 percent of changes in the real value of imports.

4.4 Discussion

In this research, REER captures the effect of price competitiveness on Zambia's exports and imports with respect to the rest of the world. As earlier reviewed in the functional definition, REER encompasses a number of factors that determine it, including Nominal Exchange Rates, Terms of Trade, Closeness of Domestic Market (i.e. policies on tariff barriers, non-tariff barriers trade regulations, etc) and domestic inflation.

In the statement of the problem, we had alluded to the fact that depreciation of REER does not guarantee an automatic improvement in a country's BoP, unless certain conditions (such as the Marshall-Lerner condition) are met. The Marshall-Lerner Condition requires that for depreciation to be effective, as an expenditure switching mechanism between domestically produced goods and foreign produced goods, in improving trade balances, the sum of the foreign elasticity of supply for exports and the (absolute) domestic elasticity of demand for imports, due to 1 percent depreciation, must be greater than 1. Therefore, our discussion on the policy implications of the results presented in the previous section is based on the threshold provided by the Marshall-Lerner condition.

In this regard, Zambia's net gain from trade due to 1 percent depreciation was measured by a resultant sum of the adverse price effect given by -1 percent and the

net elasticity of trade balances due to depreciation given by export elasticity minus import elasticity, due to 1 percent REER depreciation {i.e. net gain = price effect (-1 percent) + volume effect ($REER_{ex}^{coefficient} - REER_{im}^{coefficient}$)}.

Therefore, in the short-run of about 6 months (i.e. within two quarters) the Marshall-Lerner condition is fulfilled since Zambia's net gain from trade in the two SEECMs is 0.63 {i.e. -1 + [1.03 – (-0.60)]}as captioned by short-run REER coefficients. Nonetheless, it is noteworthy to hastily point out the fact that the success of depreciation in the short-run of about 6 months is not by virtue of it acting as an expenditure switching mechanism between domestically produced goods and foreign produced goods. As we will notice in the deliberation below, the success of depreciation in this period can only be attributable to the behavioural adjustment phase for importers who temporarily realise that imports have become expensive and hold back on the consumption of imported goods.

According to the long-run results, depreciation of REER by 1 percent will increase non-traditional exports by 0.79 percent (as desired) and at the same time imports will (undesirably) increase by 0.31percent. In this regard, depreciation will undesirably lead to an increase in imports through a transmission mechanism via exports and domestic income. Initially, 1 percent depreciation in the REER will cause exports to increase at a quicker rate and more proportionately than the reduction in imports. Consequently, an increase in exports implies an immediate increase in income, which variable positively and highly impact on imports more than REER induces a reduction in import. Therefore, in the long-run, depreciation will ultimately necessitate an increase in imports, which leads to a net loss in trade balances of 0.52 (measured in terms of elasticity i.e. -1 + [0.79 – (+0.31)]).

CHAPTER 5

CONCLUSION AND POLICY IMPLICATIONS

Firstly, econometrics literature suggests that most macroeconomic variables are usually integrated of order 0 and 1 (Sjo; 2008), and so were our findings. Secondly the literature reviewed postulates that trade flow models should be cointegrated (*ibid*); our findings confirmed cointegration in both the export and import models using the Single Equation Error Correction Model Approach recommended by Sjo (2008).

Further, in the short-run, we managed to establish our main research objective that depreciation of real effective exchange rate (enhancing international competitiveness of domestic goods) improves the current account of the Balance of Payment (BoP) for Zambia through growth in non-traditional exports and reduction in imports.

However, in the long-run the Marshall-Lerner condition is not met. Because there is lack of conformity between the short and long term effects of the Real Effective Exchange Rate on imports, the deduced implication is that the short-run improvements in the current account of the BoP are not predicated on depreciation fundamentals since the long-run results show that depreciation is accompanied by a rise in both exports and imports.

This implies that despite depreciation being effective in reducing imports in the short-run, in the long-run as income mounts, people begin to demand for more

imports, certainly because of lack of domestic alternatives. This can be justified by the fact that Zambia is not a producer of most goods that compose the basket of imports such as motor vehicles, among others. Therefore, in the short-run, in Zambia depreciation can improve trade balances between imports and non-traditional exports, but not predicated on the expenditure switching mechanism between locally produced and foreign produced merchandise goods.

To this effect, depreciation may only be effective in improving the BoP unless coupled with another policy instrument that would discourage expenditure on imports due to increased income. In this case, the idea of a twin policy instrument to depreciation would be to reduce consumption of imports (herein defined) by way of targeting income since our results already confirm that income positively and highly impacts on imports.

Additionally, the empirical results on REER imply that Zambia's non-traditional exports are subject to high price competition with regard to foreign produced goods, outside the Zambian market. On the other hand, the results reflect that imports do not face conspicuous competition from locally produced goods, within the Zambian market.

Nevertheless, improvements based on fundamentals are only achievable if depreciation is coupled with some other policy instrument that would discourage expenditure on imports (im).

Therefore, this study should be extended by carrying out a further study that would investigate which suitable policy instrument might be used to discourage expenditure on imports (im) so that depreciation can be effective in improving the BoP based on fundamentals both in the short-run and long-run.

Furthermore, model formulations in the literature examine the responsiveness of trade flows to changes in income, relative prices and the exchange rate neglecting the influence of imported inputs in the previous period(s). This research fills the lacuna by providing evidence specific to Zambia through the inclusion of the Imported Input variable that captures the influence of imported factors of production of non-traditional exports in the model.

Therefore, it is imperative that policies aimed at promoting non-traditional exports also embrace promotion of imported inputs (fertilizer, petroleum and metal products) as this would further propel the increase in exporting non-traditional goods. Implementing policies that hinder importation of inputs (fertilizer, petroleum and metal products) would counter the whole purpose of depreciating the real effective exchange rate as reduced imported inputs will tend to reduce non-traditional exports. Thus, the researcher recommends that policy makers should take into consideration the role that imported inputs play in fostering growth in non-traditional exports and henceforth pursue policies that do not hamper importation of inputs, if depreciation has to improve the BoP .

Finally, the study had a limitation of not having data for one of the key variables. In this instance, in Zambia, the Gross Domestic Product which would have been a better proxy for quarterly domestic income is not compiled on a quarterly basis but yearly. Given that studies of this nature entail the use of quarterly data, the researcher was compelled to proxy for quarterly domestic income with the quarterly total real value of imports as reported in the BoP, which is a crude proxy but nonetheless served the purpose. In this regard, the researcher recommends that the Central Statistical Office, the Bank of Zambia and other stakeholders, responsible for collecting and compiling Zambia's economic data, urgently improvise an index for the quarterly domestic income that would be more representative other than the real total value of imports (herein used) to help future researchers that need to use quarterly GDP data.

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APPENDICES

Appendix 1 Base-Line Export and Import Models

With reference to chapter two (literature review), there are three approaches that endeavor to explain factors that determine the trade balance, namely, the elasticity approach, absorption approach and monetary approach.

- According to the elasticity approach depreciation improves the trade balance by changing the relative prices between domestically and foreign sourced goods (expressed in the RER).

- In the absorption approach an exchange rate change can only affect the trade balance if it induces an increase in income which is greater than the increase in total domestic expenditure (absorption).

- The monetary approach asserts that exchange rate changes have only temporary effects. Hence, there should be no long-run equilibrium relationship between the trade balance and exchange rates. With respect to income variable in the short run the monetary approach assumes that an increase in income improves the trade balance, assuming that the Keynesian hypothesis of 0<MPC<1 holds.

Standard base-line models for export supply and import demand are derived to capture the effects of all the factors followed by these three approaches, as recently developed by Krugman and Baldwin (1987), Rose and Yellen (1989), Rose (1991), Baharumshah (2001). The standard models are derived from foreign and domestic countries' demand for imports and supply of exports, respectively. Accordingly, it is posited that the demand for imports by a country depends upon the relative price of imports and domestic real income, mathematically represented as follows:

$M_{ij}^{d} = f(RP_{mi}, Y_i)$…….. (24)

Where,

M_{ij}^{d} is the domestic demand for imports by country i,

RP_{mi} is the relative price of imported goods to domestically produced goods, and

$Y_i$is the domestic real income.

Let $ERji$ be the nominal exchange rate, defined as the price of one unit of domestic currency in terms of foreign currency; that is, the number of units of foreign currency per unit of domestic currency. The relative price of imported goods can be expressed as

$$RP_{mi} = \frac{P_{xj}}{ER_{ji}P_i} = \left(\frac{P_j}{ER_{ji}P_i}\right)\left(\frac{P_{xj}}{P_j}\right) = \left(RER_{ji}\right)RP_{xj} \ldots\ldots\ldots\ldots\ldots \quad (25)$$

Where,

$P_{xj}$is the foreign currency price of foreign exports,

P_i and P_j are the domestic (country i's) price indices and foreign (country j's) price indices of all goods respectively,

RER_{ji} is the real exchange rate, defined as RER_{ji} = [(1/ER_{ji}) (Pj / Pi)], so that an increase in RER_{ji} signifies an appreciation of the home (i's) currency, and RP_{xj} is the relative price of foreign (j's) exports of foreign produced goods. SubstitutingRP_{mi} from Equation (2) into Equation (1) gives the following equation

$$M_{ij}^d = f(RER_{ji}RP_{xj}, Y_i) \ldots\ldots\ldots \quad (26)$$

Similarly, the foreign country's demand for imports depends upon foreign real income (Y_i) and domestic relative export prices.

$$M_{ji}^d = f(RP_{xj}/RER_{ji}, Y_j) \ldots\ldots\ldots\ldots\ldots \quad (27)$$

Given that domestic exports equal foreign imports and that domestic (i) countries' supply of exports to foreign (j) country (X_{ij}^s) equals demand for imports by foreign (j) country from domestic (i) country (M_{ji}^d) we derive the export supply model as follows: since

$M_{ji}^d = X_{ij}^s$, therefore, $X_{ij}^s = f(RP_{xj}/RER_{ji}, Y_j)$…….. (28) is our base-line export supply model.

Adapted from Khan and Hossain (2010)

Appendix 2 Data Set

Table 6: Data Set

time	CPI	NEER	RP	REER	REERindex	*ln* REERInd	e (KR/ $)	tot exp	met exp	ntexp	tot imp	imp(im)	inpt(IM)
2000q4	40.7291	1.12009	2.16065	2.420136	190.1711	5.247924	3.68522	1894.765	1266.534	628.2313	2278.327	1569.877	708.4505
2001q1	44.3813	1.12992	1.99545	2.254701	177.1714	5.177117	3.65893	1745.981	1222.286	523.6949	2772.737	1622.081	1150.656
2001q2	44.5541	0.989958	2.01094	1.990746	156.4301	5.052609	3.34399	1712.532	1174.093	538.4387	2282.767	1441.983	840.7843
2001q3	45.2295	1.07871	1.98425	2.140429	168.1921	5.125107	3.6526	1864.767	1233.552	631.2148	2523.772	1449.569	1074.203
2001q4	48.0047	1.04114	1.87115	1.948121	153.0807	5.030965	3.78822	1682.632	1042.718	639.9139	2367.044	1425.462	941.5822
2002q1	52.8009	1.00248	1.72459	1.728864	135.8518	4.911564	3.89449	1841.411	1365.027	476.384	2261.442	1563.486	697.9564
2002q2	53.7958	1.13384	1.72379	1.954498	153.5818	5.034234	4.13043	1722.111	1142.302	579.8094	2291.405	1565.313	726.0919
2002q3	55.9374	1.27833	1.67788	2.144879	168.5417	5.127183	4.5037	1862.329	1149.912	712.4169	2352.704	1540.542	812.1622
2002q4	60.142	1.38907	1.5829	2.198754	172.7752	5.151991	4.69901	2031.118	1098.673	932.4456	2396.634	1228.271	1168.362
2003q1	65.0587	1.51093	1.47332	2.226083	174.9226	5.164344	4.65271	1540.241	1024.165	516.0764	2559.009	1606.757	952.2526
2003q2	66.2525	1.64266	1.44799	2.37856	186.904	5.230595	4.84583	1975.808	1179.256	796.5526	2385.416	1527.235	858.1801
2003q3	67.4123	1.61959	1.41135	2.285811	179.616	5.190821	4.74039	2062.593	1268.218	794.3757	2303.032	1387.641	915.3901
2003q4	71.609	1.71357	1.32745	2.274685	178.7417	5.185942	4.69647	1876.854	1233.22	643.6341	2499.179	1643.657	855.5226
2004q1	76.3032	1.77078	1.24897	2.211652	173.7886	5.15784	4.73523	2441.574	1874.403	567.1705	2215.336	1019.228	1196.107
2004q2	78.1306	1.78053	1.2329	2.195205	172.4962	5.150375	4.77409	2821.468	2144.932	676.5358	3159.432	2138.848	1020.583
2004q3	80.0182	1.83468	1.2192	2.236841	175.7679	5.169165	4.80825	2903.097	2121.272	781.8249	2494.816	1588.601	906.2149
2004q4	84.4532	1.91008	1.1657	2.226568	174.9608	5.164562	4.78233	2754.194	2041.756	712.4379	2478.658	1781.127	697.5311
2005q1	90.1134	1.91654	1.09374	2.096192	164.7159	5.104222	4.75267	2262.3	1661.806	600.4948	2210.36	1307.862	902.4975
2005q2	92.9671	1.80645	1.06527	1.924356	151.2133	5.018692	4.68306	2600.495	1923.239	677.256	2774.774	2164.27	610.5042
2005q3	95.3548	1.68643	1.04267	1.758395	138.1723	4.928502	4.48627	2805.261	2096.439	708.8211	2823.659	1919.431	904.2286
2005q4	98.9077	1.47106	1.01122	1.487561	116.8906	4.761238	3.93875	2655.032	2116.026	539.0067	2352.088	1336.75	1015.338
2006q1	100	1.26887	1	1.27261	100	4.60517	3.31688	2440.677	1973.558	467.1187	1843.233	1031.755	811.4775
2006q2	101.193	1.25635	1.0037	1.261004	99.08798	4.596008	3.28255	3716.854	3125.208	591.6467	2132.024	1388.06	743.9632
2006q3	103.253	1.46503	0.992305	1.453755	114.2342	4.73825	3.82363	4040.346	3347.789	692.5576	2510.498	1331.682	1178.816
2006q4	106.872	1.47317	0.963515	1.419419	111.536	4.714348	3.97788	3416.895	2653.642	763.2538	2772.617	1732.182	1040.435
2007q1	111.778	1.58576	0.926398	1.469046	115.4357	4.748713	4.24664	3238.177	2660.076	578.1019	2839.226	1426.56	1412.666
2007q2	113.092	1.5349	0.932463	1.431243	112.4651	4.722643	4.0222	4071.152	3326.055	745.0962	2915.449	1566.388	1349.061
2007q3	113.969	1.5058	0.934818	1.407648	110.6111	4.70602	3.93398	4551.895	3779.192	772.7034	3410.443	1912.727	1497.716
2007q4	116.373	1.5211	0.931154	1.416383	111.2975	4.712207	3.81275	3711.269	3071.612	639.6573	3458.036	1760.556	1697.479
2008q1	122.446	1.46684	0.899549	1.319494	103.6841	4.641348	3.73819	4025.584	3502.211	523.3735	2787.778	1418.96	1368.817
2008q2	125.578	1.3322	0.898638	1.197162	94.07136	4.544054	3.39476	3897.564	3287.815	609.7484	3313.725	1468.72	1845.005
2008q3	129.225	1.33818	0.887977	1.188273	93.37291	4.536601	3.47428	3244.385	2488.646	755.7394	3807.813	1820.731	1987.083
2008q4	134.626	1.45795	0.850601	1.240134	97.44804	4.579319	4.39317	2979.512	2333.16	646.3511	3259.989	1660.607	1599.382
2009q1	140.011	1.75465	0.810151	1.421535	111.7023	4.715837	5.32497	2472.274	1939.893	532.3813	2592.015	1367.675	1224.341
2009q2	143.721	1.90179	0.794255	1.510506	118.6935	4.776545	5.30209	3276.728	2551.94	724.7875	3027.86	1041.294	1986.566
2009q3	146.972	1.85627	0.782598	1.452713	114.1522	4.737533	4.86217	4314.238	3358.692	955.5463	2915.09	1718.759	1196.331
2009q4	149.737	1.83978	0.772303	1.420869	111.6499	4.715369	4.65392	4352.778	3499.961	852.816	3201.203	2027.905	1173.298
2010q1	153.782	1.77694	0.756609	1.344445	105.6447	4.660082	4.62501	4986.375	4179.614	806.762	3364.456	1837.898	1526.558
2010q2	156.235	1.8423	0.751196	1.383928	108.7472	4.689026	4.91425	5164.745	4225.026	939.7186	3612.471	2031.376	1581.094
2010q3	158.903	1.92128	0.737804	1.417527	111.3874	4.713014	4.9319	6018.726	4997.655	1021.071	3520.415	2157.76	1362.655
2010q4	160.869	1.93166	0.732857	1.415633	111.2385	4.711677	4.70803	5919.231	5058.702	860.5284	3829.388	2619.651	1209.737
2011q1	167.77	1.96599	0.70922	1.394322	109.5639	4.696508	4.76365	5997.564	5217.525	780.0394	3901.65	2338.267	1563.382
2011q2	170.111	2.05146	0.708199	1.45284	114.1622	4.73762	4.75519	5768.7	4742.745	1025.955	4267.182	2463.251	1803.93
2011q3	172.724	2.10805	0.700108	1.475862	115.9712	4.753342	4.86586	6524.111	5282.572	1241.539	4980.917	3123.235	1857.682
2011q4	173.528	1.97354	0.699583	1.380658	108.4903	4.68666	5.0269	5853.008	4363.71	1489.299	5172.426	3514.232	1658.194

Note: applicable variables in the data set are reported in real million ZMW (2006q1=100).

Appendix 3 Diagnostic Tests

Figure 4: Graph Matrix for ln(ex)

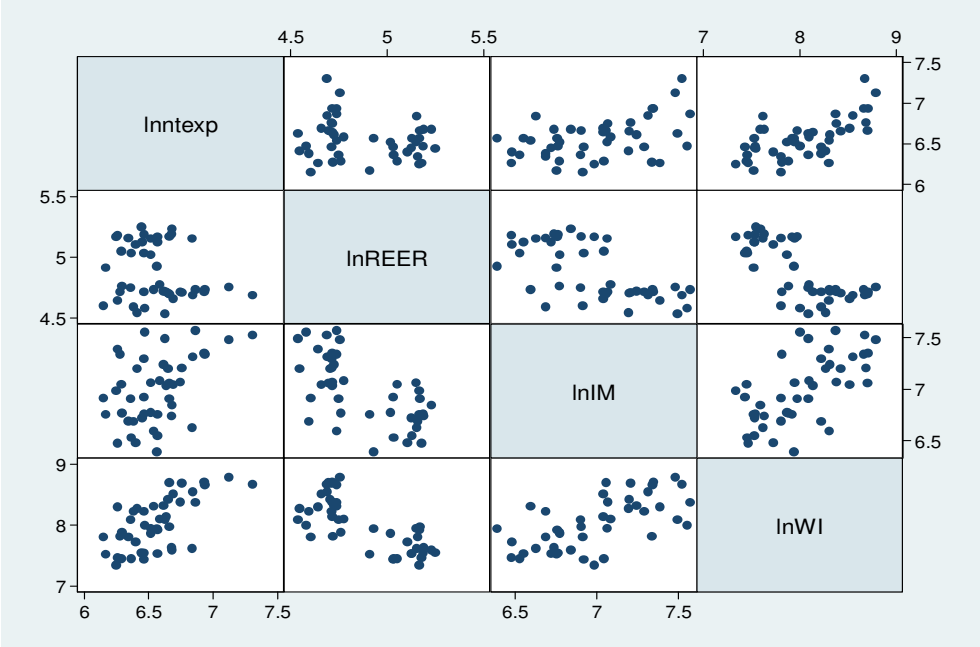

Figure 5: Graph Matrix for ln(im)

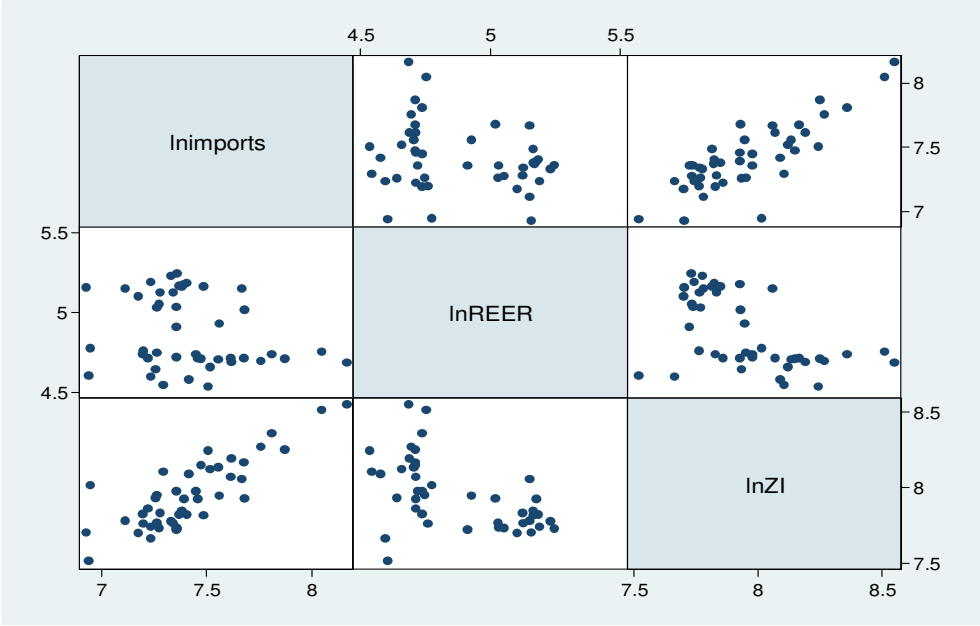

Figure 6: Kernel Density for Equation 20

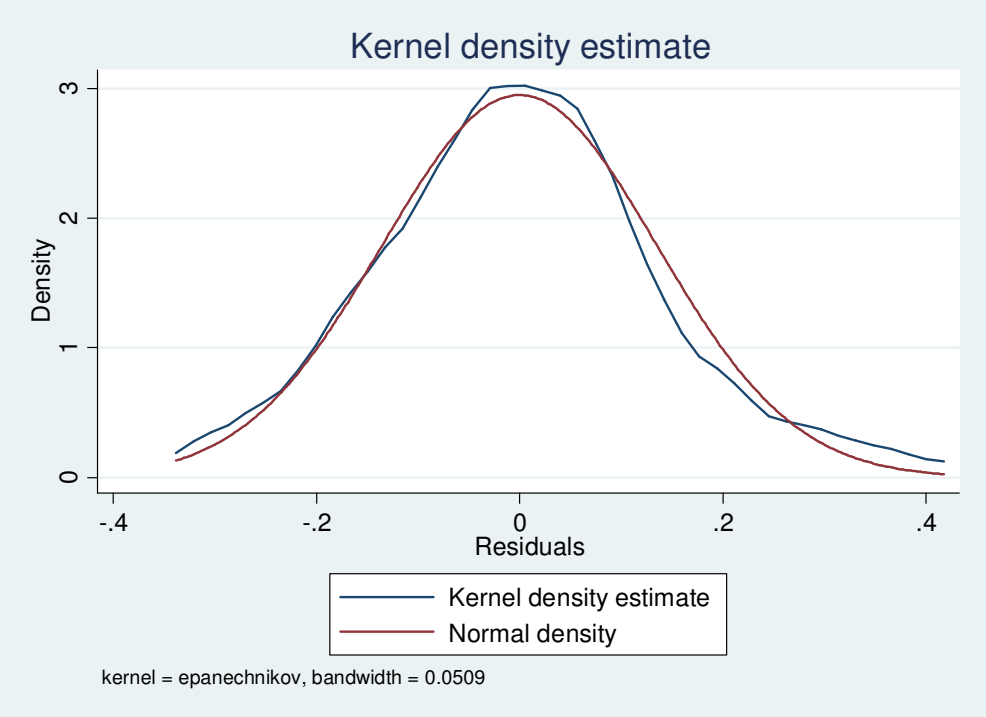

Figure 7: Kernel Density for Equation 21

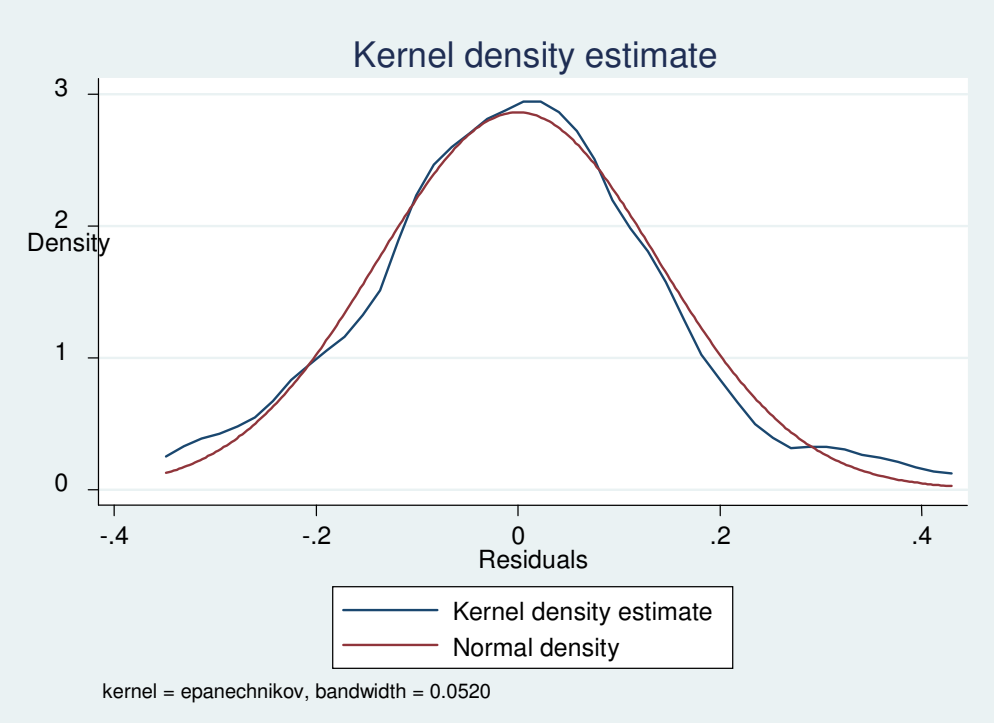

Figure 8: Kernel Density for Equation 22

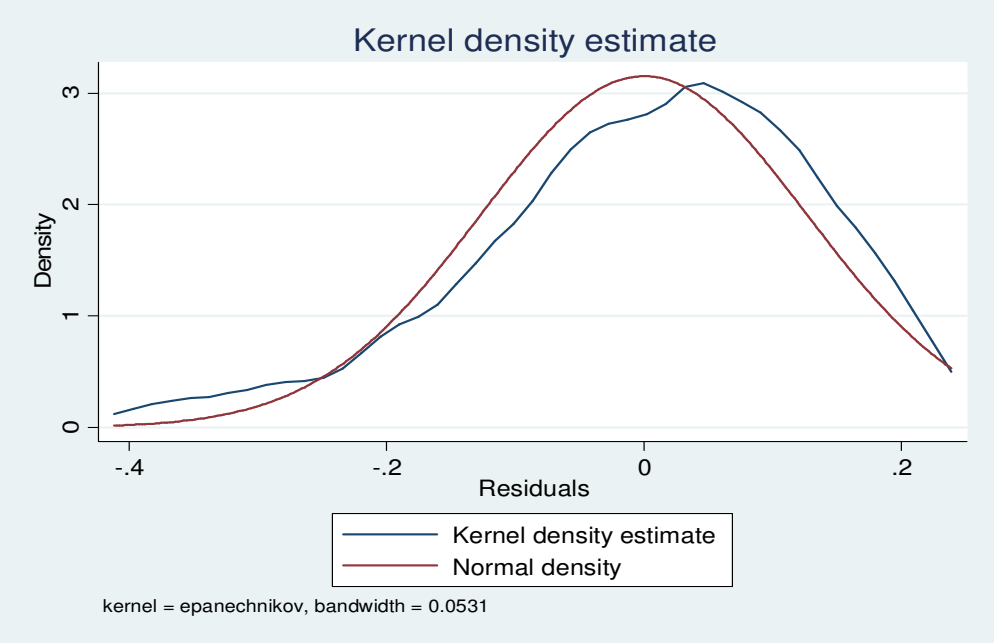

Figure 9: Kernel Density for Equation 23

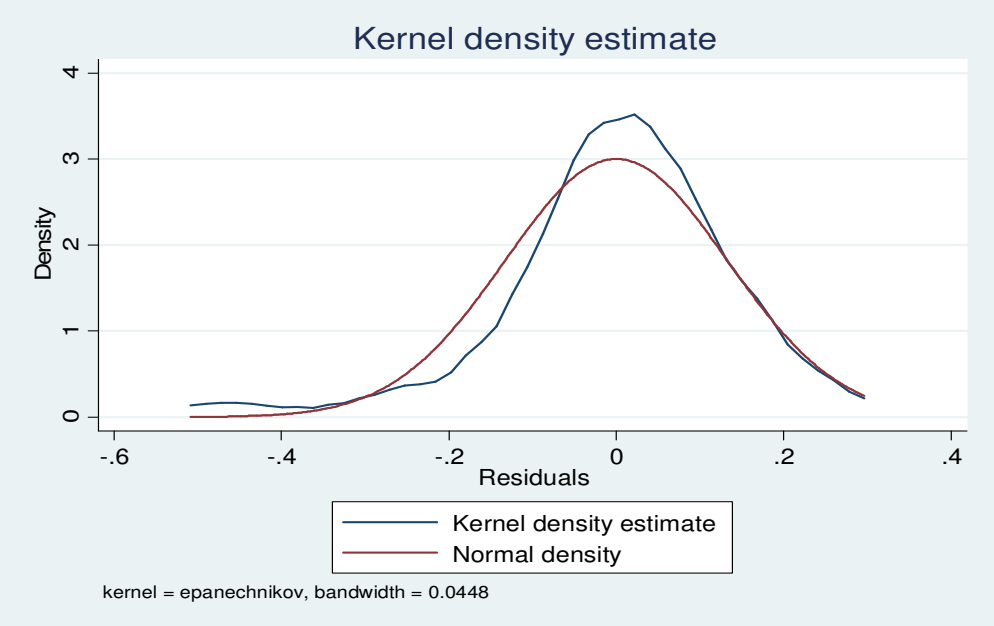

Table 7: Diagnostic Tests

Test	Test Statistics for Equations:				H_0: there is	Conclusion
	20	21	22	23		
swilk	0.86	0.81	0.023**	0.06*	normality	Residuals from all the

						models are normally distributed
vif	1.24	2.61	2.13	2.15	No multicollinearity	There is no multicollinearity in all the models
imtest	0.81	0.45	0.30	0.52	Homogeneity	There is homoskedasticity in all the models
hettest	0.21	0.34	0.47	0.54		
linktest	0.138	0.14	0.33	0.10	No model mis-specification	There are no omitted variable(s) and there is no model mis-specification in all the models
ovtest	0.11	0.29	0.68	0.30		
dwstat	1.82≈2	1.76≈2	2.00=2	2.01≈2	No serial correlation	There is no serial correlation in all the models
bgodfrey	0.98	0.49	0.74	0.13		

Recall: (***) implies significance at 1, 5 and 10 percent levels, (**) implies significance at 5 and 10 percent and (*) implies significance at 10 percent only. Notice that the vif and dwstat tests do not use p-values. For the vif value more than 10 then there is a problem of multicollinearity. For dwstat≈2 then there is no problem of serial autocorrelation.

Appendix 4 Key Terminologies and/ or Concepts

The **Balance of Payments** (BoP) is a statistical record of all the economic transactions between residents of the reporting country and residents of the rest of the world at a given period. Basically, the BoP is composed of two major accounts, namely, Current Account and Capital Account and a minor one, the Net Errors and Omissions Account.

The **Current Account** in the BoP records the sum of visible (physical merchandise) goods and the invisible services imported and exported at a given period.

The **Capital Account** of the BoP records transactions for movement of financial capital in and out of the country.

Trade Flows are the quantities or value of a country's multilateral trade with the rest of the world due to exports and imports.

Relative Price (RP) is the ratio of the index for world's general price level (denoted by p^*) to the index for domestic general price level (denoted by p); thus RP= p^*/p

Exchange Rate (e) is defined as the price of one currency in terms of another. This can be expressed in two forms, that is: (a) Domestic currency units per unit of foreign currency; and (b) Foreign currency units per unit of domestic currency. Hereinafter, we shall use the former expression in preference to the latter, such that raising the exchange rate value will imply depreciation of the domestic currency.

Exchange rate can be expressed in nominal, real, and/ or effective form.

Nominal Exchange Rate (NER) is the prevailing weighted rate at a given point in time. In this case, the amount of kwacha required to buy a unit of foreign weighted currencies of countries that trade with Zambia.

Real Exchange Rate (RER) is the nominal exchange rate adjusted for relative prices; thus **RER = NER** X**RP.**

Effective Exchange Rate (EER) is a measure of how the domestic currency appreciates or depreciates against a weighted basket of foreign currencies with which it trades. A blending of real exchange rate and effective exchange rate concepts yields a variable known as the **Real Effective Exchange Rate (REER**). In the same way a blending of concepts of nominal exchange rate and effective exchange rate yields a variable known as the **Nominal Effective Exchange Rate (NEER**).

Thus, in this study, a rise in the real effective exchange rate index signifies a **real depreciation** of the local currency against the rest of the world, while a fall indicates a **real appreciation.**

Purchasing Power Parity (PPP) Theory asserts that nominal exchange rates adjust to offset changes in relative prices, so that REER can remain at a constant value in the long-run.

Stationary Time Series Variable: A time series variable is stationary if the mean, variance and autocorrelation can be well approximated for, using sufficiently long time averages based on a single set realization of data. Consequently, use of non-stationary time series data will give spurious and misleading results.

A time series variable is said to be **integrated of order d** "**I(d)**" if it becomes stationary {i.e. I(0)} after differencing it **d** times.

Cointegration is a statistical property of time series variables. Two or more time series variables in a system are cointegrated if they share a common stochastic drift suggesting a long-run relationship for the variables.

An **Error-Correction Model (ECM)** is a dynamic model in which the movement of the variables in any period is related to the previous period's gap from long-run equilibrium. In an error correction model, the short-term dynamics of the variables in the system are influenced by both deviations from the long-run equilibrium and current changes. The principle behind the ECM is that if there is a long-run equilibrium relationship among economic variables, then a certain proportion in the short-run disequilibrium must be corrected in the subsequent periods of the long-run through the error correction mechanism. In this case, the rate of correction will be determined by the coefficient of the error correction mechanism.

Appendix 5 Motivation for Ideal Measurement of REER

Mungule (2004) devised a measurement of Zambia's real effective exchange rate for use in trade flow analysis in two forms. The first one was derived using the foreign copper price while on the second he used crude oil import prices. He presented the two forms, derived based on the PPP theory condition, as follows:

First, he used the real exchange rate equation, as per PPP theory, given by

RER = PT/PN…… (29)

Where,

RER is the real exchange rate and PT and PN are the domestic price indexes for tradable goods and non-tradable goods, respectively. Thus, three proxies will be used in an operational definition for RER, as follows:

$RER_{it} = (E_{it}.FPT)/PN$…… (30)

Where,

$RER_i = BRER_i$ …….. (31)

Which is the Bilateral real exchange rate index with country i

E_{it} = nominal exchange rate measured as the Zambian kwacha per unit of country I's currency in period t.

FPT = foreign currency price of tradable goods, approximated by the world copper price indexes (CuPI) and weighted foreign import price index (WFIPI).

PN = as defined above and approximated using Zambia consumer price index (CPI).

Empirical calculation for indexes:

$BRERI_{cut} = (E_{it} .CuPI_t)/CPI_t$ ……. (32)

Where,

$BRERI_{cu}$ is the bilateral RER index calculated using foreign copper price index (CuPI) as a proxy for foreign price (FP) of tradable goods; and

$BRERI_{imt} = (E_{it} .WFIPI_t)/CPI_t$ Where,

$BRERI_{im}$ is the bilateral RER index calculated using Zambia's weighted foreign import price index as a proxy for FP.

Thus, the real effective exchange rate (REER) index was calculated using trade weights for six major trading partners by multiplying the bilateral real exchange rates with the trade weights and summing the products as follows:

$REER_{cut} = BRERI_{cu1}.W_1 + BRERI_{cu2}.W_2 +...+ BRERI_{cu6}.W_6$ …….. (33)

Where,

$REER_{cu}$ = foreign copper price based real effective exchange rate index.

W = trade weights for countries 1, 2...6 which are Zambia's major trading partners

or

$$REER_{imt} = BRERI_{im1}.W_1 + BRERI_{im2}.W_2 +...+ BRERI_{im6}.W_6 \ldots\ldots\ldots\ldots (34)$$

Where,

$REER_{im}$ = weighted foreign import price based real effective exchange rate index.**Adapted from Mungule (2004)**

Appendix 6 Variable Description

Table 8: Variable Description

variable	Description
$ln(REER)_t$	Natural log of quarterly Real Effective Exchange Rate Index (2006Q1=100); source: BoZ. REER is reported on a monthly basis by BoZ. Averaging was used to compute quarterly REER
$ln(ex)_t$	Natural log of real value of exports excluding metals (CPI 2006Q1=100) and expressed in ZMK (millions); source: 2012 BoP
$ln(im)_t$	Natural log of real value of imports excluding petroleum, fertilizer and all metals (CPI 2006Q1=100) and expressed in rebased kwacha (millions); source: 2012 BoP
$ln(IM)_{t-1}$	Natural log of real value of imports for inputs including only petroleum, fertilizer and all metals (CPI 2006Q1=100) and expressed in ZMW (millions); source: 2012 BoP
$ln(zi)_t$	Natural log of real value of income proxied by real value of Zambia's total imports (CPI 2006Q1=100) and expressed in ZMW (millions);

	source: 2012 BoP
$ln(wi)_t$	Natural log of real value of weighted income for major importers of Zambia's exports proxied by total Zambia's exports (CPI 2006Q1=100) and expressed in ZMW (millions); source: 2012 BoP
r_t	Predicted errors from the long-run export supply model obtained from the Bewley's Transformation regression
rr_{t-1}	Predicted errors from the SEECM for exports
e_t	Predicted errors from the long-run import demand model obtained from the Bewley's Transformation regression
ee_{t-1}	Predicted errors from the SEECM for imports
Note: all entries in the BoP are reported in million dollars; therefore conversions to kwacha were made based on the respective quarterly (ZMW/$) rates obtained from averaging BoZ monthly rates.	

Appendix 7 Summary of Statistics for Variables

Table 9: Summary of Statistics for Variables

Variable	$REER_t$	ex_t	im_t	IM_{t-1}	zi_t	wi_t	r_t	rr_t	e_t	ee_t
No. of obs	45	45	45	44	45	45	43	43	45	42
Mean	4.88	6.56	7.42	6.99	7.95	8.02	0	0	0	0
Std. Deviation	.23	.25	.26	.33	.23	.42	.14	.14	.13	.13
Min. Value	4.54	6.15	6.93	6.39	7.52	7.34	-.30	-.29	-.51	-.36
Max. value	5.25	7.31	8.17	7.57	8.55	8.78	.38	.37	.24	.19

Note: REER, ex, im, IM, zi and wi were expressed in natural log form (*ln*)

Appendix 8 Stata Output for the Four Models

Table 10: Export Models (OLS, SEECM and Bewley's Transformation)

```
. regress lnex lnREER lnIM lnWI
```

Source	SS	df	MS	Number of obs =	44
				F(3, 40) =	24.58
Model	1.71983945	3	.573279818	Prob > F =	0.0000
Residual	.932800002	40	.02332	R-squared =	0.6484
				Adj R-squared =	0.6220
Total	2.65263946	43	.06168929	Root MSE =	.15271

lnex	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnREER	.8003007	.160276	4.99	0.000	.4763708	1.124231
lnIM	.2096527	.0985468	2.13	0.040	.0104821	.4088233
lnWI	.5889659	.0845341	6.97	0.000	.4181162	.7598157
_cons	-3.531841	1.474842	-2.39	0.021	-6.512608	-.5510734

```
. predict v, residual
(1 missing value generated)

. regress d.lnex  l.v l.d.lnex d.lnREER d.lnIM d.lnWI
```

Source	SS	df	MS	Number of obs =	43
				F(5, 37) =	10.72
Model	1.11444441	5	.222888883	Prob > F =	0.0000
Residual	.769170702	37	.020788397	R-squared =	0.5917
				Adj R-squared =	0.5365
Total	1.88361512	42	.044847979	Root MSE =	.14418

D.lnex	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
v						
L1.	-.807593	.197715	-4.08	0.000	-1.208202	-.4069843
lnex						
LD.	.1908135	.1258026	1.52	0.138	-.0640867	.4457137
lnREER						
D1.	1.032086	.3248017	3.18	0.003	.3739751	1.690196
lnIM						
D1.	.2143458	.0922495	2.32	0.026	.0274306	.401261
lnWI						
D1.	.6729808	.1536397	4.38	0.000	.3616772	.9842845
_cons	.0013825	.0230515	0.06	0.952	-.0453242	.0480892

```
. regress   lnex dlnexhat lnREER   lnIM  lnWI d.lnREER d.lnWI d.lnIM
```

Source	SS	df	MS	Number of obs =	43
				F(7, 35) =	10.72
Model	1.74660366	7	.249514809	Prob > F =	0.0000
Residual	.814945441	35	.023284155	R-squared =	0.6819
				Adj R-squared =	0.6182
Total	2.5615491	42	.060989264	Root MSE =	.15259

lnex	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dlnexhat	-.5377657	.2805598	-1.92	0.063	-1.107332	.0318009
lnREER	.7874133	.1687112	4.67	0.000	.4449114	1.129915
lnIM	.1631707	.1201833	1.36	0.183	-.0808143	.4071557
lnWI	.6205802	.0949651	6.53	0.000	.4277908	.8133697
lnREER						
D1.	.8377024	.4448699	1.88	0.068	-.0654316	1.740836
lnWI						
D1.	.3734943	.2653853	1.41	0.168	-.1652666	.9122551
lnIM						
D1.	.1412469	.1262831	1.12	0.271	-.1151215	.3976153
_cons	-3.386699	1.594084	-2.12	0.041	-6.622861	-.1505372

```
.
```

Table11: Import Models (OLS, SEECM and Bewley's Transformation)

```
. regress lnim lnREER lnZI
```

Source	SS	df	MS		
Model	2.17267782	2	1.08633891	Number of obs	= 45
				F(2, 42)	= 56.62
Residual	.80584759	42	.019186847	Prob > F	= 0.0000
				R-squared	= 0.7294
				Adj R-squared	= 0.7166
Total	2.97852541	44	.067693759	Root MSE	= .13852

lnim	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnREER	.3062	.106537	2.87	0.006	.0911996	.5212004
lnZI	1.095902	.1068473	10.26	0.000	.8802755	1.311529
_cons	-2.789929	1.203613	-2.32	0.025	-5.218917	-.3609399

```
. predict U, residual

. regress d.lnim l.U l.d.lnim d.lnREER d.lnZI l2.d.lnim l.d.lnREER l.d.lnZI
```

Source	SS	df	MS		
Model	1.82991091	7	.261415844	Number of obs	= 42
				F(7, 34)	= 13.53
Residual	.656738876	34	.019315849	Prob > F	= 0.0000
				R-squared	= 0.7359
				Adj R-squared	= 0.6815
Total	2.48664979	41	.060649995	Root MSE	= .13898

D.lnim	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
U						
L1.	-.8758232	.2289571	-3.83	0.001	-1.34112	-.4105263
lnim						
LD.	-.0514773	.1922295	-0.27	0.790	-.4421346	.3391801
lnREER						
D1.	.0129715	.3470764	0.04	0.970	-.6923725	.7183156
lnZI						
D1.	1.228334	.1783218	6.89	0.000	.86594	1.590727
lnim						
L2D.	.0795942	.1110474	0.72	0.478	-.1460812	.3052696
lnREER						
LD.	-.6037617	.354488	-1.70	0.098	-1.324168	.1166446
lnZI						
LD.	.2299449	.2682646	0.86	0.397	-.3152344	.7751242
_cons	-.0145705	.0227214	-0.64	0.526	-.0607459	.0316049

```
. regress  lnim dlnimhat  lnREER  lnZI d.lnREER d.lnZI
```

Source	SS	df	MS		
Model	2.23138547	5	.446277095	Number of obs	= 44
				F(5, 38)	= 22.81
Residual	.743617656	38	.019568886	Prob > F	= 0.0000
				R-squared	= 0.7500
				Adj R-squared	= 0.7172
Total	2.97500313	43	.069186119	Root MSE	= .13989

lnim	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dlnimhat	-.1662328	.1867883	-0.89	0.379	-.5443659	.2119004
lnREER	.3143675	.1139458	2.76	0.009	.0836963	.5450386
lnZI	1.118085	.1234275	9.06	0.000	.8682195	1.367951
lnREER						
D1.	-.5058311	.3148502	-1.61	0.116	-1.143212	.1315497
lnZI						
D1.	.2640199	.2872606	0.92	0.364	-.3175087	.8455486
_cons	-3.016095	1.365323	-2.21	0.033	-5.780046	-.2521439

```
.
```